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12 Attorneys for Plaintiffs
13 **JAPAN CASH MACHINE CO., LTD. AND**
14 **JCM AMERICAN CORPORATION**

11 UNITED STATES DISTRICT COURT

12 DISTRICT OF NEVADA

13 2:05-cv-01433

14 JAPAN CASH MACHINE CO.,
15 LTD., a Japanese Corporation and
16 JCM AMERICAN
17 CORPORATION, a Nevada
18 corporation,

19 Plaintiffs,

20 vs.

21 MARS ELECTRONICS
22 INTERNATIONAL, INC., a
23 Delaware corporation

24 Defendant.

COMPLAINT FOR PATENT
INFRINGEMENT

JURISDICTION AND VENUE

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2 A. This Court has subject matter jurisdiction under 28 U.S.C. §§ 1331,
3 1338 based upon the federal causes of action.

4 B. Venue is proper within this Judicial District and its southern division
5 under 28 U.S.C. §§ 1391, (b) and (c), 1400(b) . A substantial amount of the events
6 and injury occurred in this judicial district and Plaintiff JCM American Corporation
7 resides in this district. Plaintiff Japan Cash Machine Co., Ltd. is a foreign
8 corporation. Defendant Mars Electronics International, Inc. ("MEI") is a Delaware
9 corporation and a subsidiary of Mars International ("Mars"), which is also a
10 Delaware corporation. MEI has a place of business in this judicial district. MEI
11 also transacts business in this district, including selling products, participating in
12 trade shows and industry meetings, as well as hosting an internet site accessible
13 within this judicial district on which products and services are offered targeting
14 consumers in this judicial district. Further, MEI has performed acts in furtherance
15 of the illegal and wrongful conduct alleged in this Complaint which have had
16 substantial effects in this district.

THE PARTIES

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18 1. Plaintiff Japan Cash Machine Co., Ltd. ("Japan Cash") is a Japanese
19 corporation having its principal place of business in Osaka, Japan. Plaintiff JCM
20 American Corporation ("JCM") is a Nevada corporation with its principal place of
21 business at 925 Pilot Road, Las Vegas, Nevada, 89119.

22 2. Upon information and belief, Plaintiffs allege that defendant MEI is a
23 Delaware Corporation with its headquarters at 1301 Wilson Drive, West Chester,
24 Pennsylvania 19380 and a place of business at 2700 East Patrick Lane, Suite #1,
25 Las Vegas, Nevada 89120

FACTUAL ALLEGATIONS AS TO ALL CLAIMS

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27 3. Plaintiffs are the premier supplier of bill validation devices
28 ("validators") used in gaming machines such as slot machines, video poker

1 machines and similar types of devices, presently in use within the international
2 gaming industry. Plaintiffs pioneered the incorporation of validators in gaming
3 machines and continue to invest heavily in the advancement and development of
4 products and proprietary technology for the gaming industry.

5 4. JCM is the exclusive distributor for Japan Cash, with respect to all
6 products in North America as well as all products sold to the gaming industry
7 worldwide.

8 5. Japan Cash is the assignee of U.S. Patent 5,420,406 ("406 Patent"),
9 which is directed to a bill validator with a bar code detector. The '406 Patent issued
10 in May of 1995 based on a U.S. application filed in December of 1993 claiming
11 priority to a Japanese application filed in December of 1992. This bill validator
12 with bar code detector patent is relevant to gaming devices which include the ability
13 to accept a bar coded ticket used in "ticket-in-ticket out" gaming machines. A true
14 and correct copy of the '406 Patent is attached as Exhibit 1.

15 6. Japan Cash is also the assignee of U.S. Patent 5,372,361 ("361
16 Patent"), directed to a bill handling apparatus. The '361 Patent issued to Japan
17 Cash in December of 1994 based on an application filed in November of 1993,
18 claiming priority to two Applications filed in Japan in November of 1992. The
19 '361 Patent is directed to a bill handling apparatus for a gaming machine having a
20 bill stacker with a removable pusher. A true and correct copy of the '361 Patent is
21 attached as Exhibit 2.

22 7. Pursuant to its exclusive distributorship rights, JCM is the exclusive
23 licensee of patents assigned to Japan Cash, including the '406 Patent and the '361
24 Patent. Japan Cash has not granted to any other company a license under either of
25 these two patents.

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Count I**Patent Infringement**

8. Plaintiffs incorporate by reference and reallege the allegations set forth in paragraphs 1 through 7 above.

9. This claim is against MEI and arises under the Patent Laws of the United States and is a claim by Plaintiffs against MEI for infringement of the '406 Patent.

10. MEI is not licensed or otherwise authorized by Plaintiffs to make, use, offer for sale, sell, import or export any of the inventions embodied in the '406 Patent.

11. On information and belief, Plaintiffs allege that MEI is infringing at least one or more of claims 1, 4, 7, 8, 9, 11 and 14 of the '406 Patent, either literally or under the doctrine of equivalents, by importing, exporting, having made, using, distributing, selling and/or offering to sell one or more products, including at least the *MEI Cash Flow™ SC Series* products, which embody the invention(s) of the '406 Patent.

12. On information and belief, Plaintiffs allege that MEI actively induces the infringement of the '406 Patent by intentionally persuading or inducing third party(s) to make, use, offer for sale, or sell the inventions embodied in the '406 Patent.

13. On information and belief, Plaintiffs allege that MEI sold or supplied to others, with knowledge of the Plaintiffs' products and patents, a material component of the '406 Patent, which was especially made for use in the patented invention, that would infringe the '406 Patent. The material component in question is not a staple article of commerce suitable for a substantial non-infringing use.

14. On information and belief, Plaintiffs allege that MEI will continue to infringe the '406 Patent with the resulting damage to Plaintiffs being substantial, continuing, and irreparable unless enjoined by this Court.

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1 be determined more fully at trial;

2 B. That Plaintiffs be awarded such damages that constitute at least their
3 lost profits, lost royalties and lost convoyed sales damages as a result of the
4 wrongful acts of Defendant MEI;

5 C. That the Court enter a preliminary and permanent injunction against
6 MEI pursuant to which MEI, including all of MEI's employees, representatives,
7 officers, directors, shareholders, investors, and all persons acting in concert or
8 participating with them, are enjoined or restrained as follows:

9 (i) from making, using, selling, offering to sell, importing and/or
10 exporting any bill validation product found to infringe the '406 Patent or any such
11 act for a bill validation product having a design which is insubstantially changed
12 from the design of any infringing product; and

13 (ii) from making, using, selling, offering to sell, importing and/or
14 exporting any bill validation product found to infringe the '361 Patent or any such
15 act for a bill validation product having a design which is insubstantially changed
16 from the design of any infringing product.

17 D. That Defendant MEI be required to pay to Plaintiffs exemplary
18 damages under 35 U.S.C. § 285;

19 E. That Plaintiffs be awarded their costs and reasonable attorneys' fees
20 under 35 U.S.C. § 285; and

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1 F. That Plaintiffs have such other relief as the Court deems just and
2 proper.

3 Dated: 12/2/05

4 By: M. D. Rounds 9176 for
5 Michael D. Rounds
6 Watson Rounds
7 5371 Kietzke Lane
8 Reno, NV 89511


9 David B. Abel
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13 Attorneys for Plaintiffs
14 Japan Cash Machine Co., Ltd. and
15 JCM American Corporation
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DEMAND FOR JURY TRIAL

Pursuant to Fed. R. Civ. P. 38(b), Plaintiffs demand a jury trial on all issues triable by a jury.

Dated: 12/2/05

By:  9176 for
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Watson Rounds
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Reno, NV 89511

David B. Abel
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Attorneys for Plaintiffs
Japan Cash Machine Co., Ltd. and
JCM American Corporation

EXHIBIT 1



US005420406A

United States Patent [19][11] Patent Number: **5,420,406**

Izawa et al.

[45] Date of Patent: **May 30, 1995**[54] **BILL VALIDATOR WITH BAR CODE DETECTOR**[75] Inventors: **Hikaru Izawa, Hadano; Masanobu Fujita, Kawasaki; Toitsu Ohya, Isehara, all of Japan**[73] Assignee: **Japan Cash Machine Co., Ltd., Osaka, Japan**[21] Appl. No.: **174,397**[22] Filed: **Dec. 28, 1993**[30] **Foreign Application Priority Data**

Dec. 28, 1992 [JP] Japan 4-349122

[51] Int. Cl.⁶ **G06F 15/30**[52] U.S. Cl. **235/379; 235/449; 235/454; 235/468**[58] Field of Search **235/379, 468, 381, 480, 235/454, 449, 493**[56] **References Cited****U.S. PATENT DOCUMENTS**

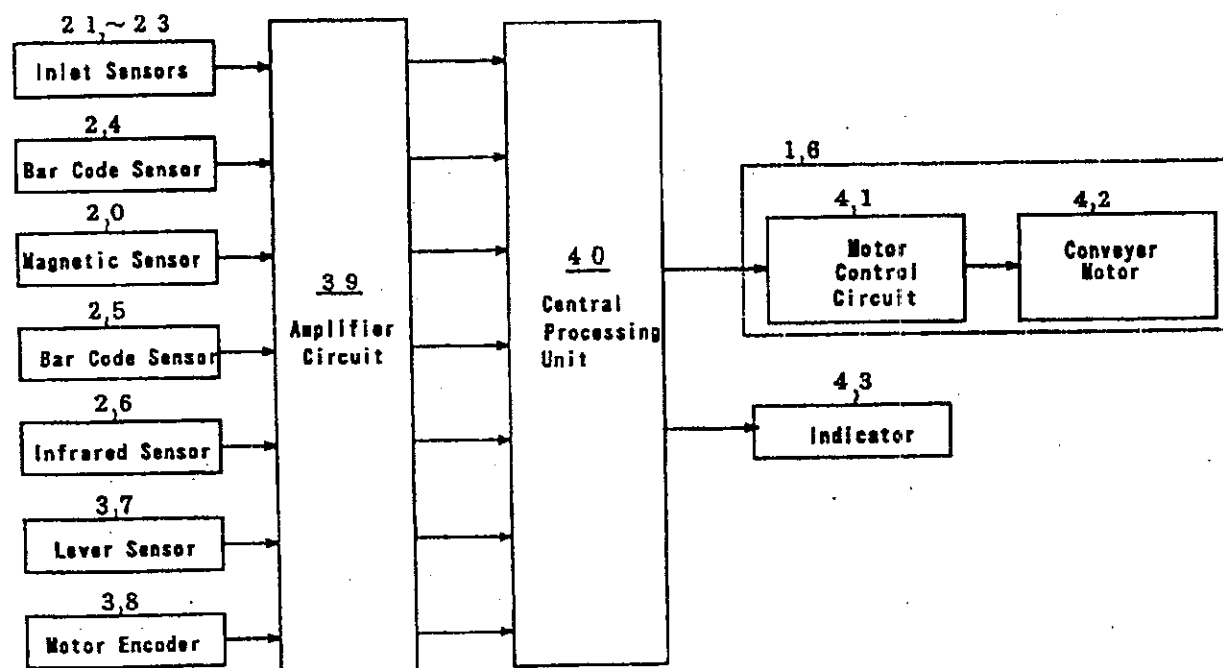
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Primary Examiner—Harold Pitts

Attorney, Agent, or Firm—Bachman & LaPointe

[57] **ABSTRACT**

A bill validator which may validate bills and bar coded documents is provided. A central processing unit of the bill validator comprises discriminator means for receiving outputs of sensor means for detecting magnetic or optical feature of the bills; and bar code detector for photoelectrically converting bar code pattern printed on a document. The discriminator means comprise an bar code comparator for receiving outputs of the optical sensors to detect bar code printed on a document; a magnetic pattern memory for storing predetermined magnetic patterns; and bar code memory for storing predetermined bar code patterns. The bar code comparator compares bar code signals read out through optical sensors from the document with bar code signals stored in the bar code memory after or before the discriminator means decides whether the document is a genuine bill or not. When the bar code comparator detects coincidence of the bar code signals from the optical sensors and bar code memory, it generates coincident signal to supply a drive signal to the meter control circuit of the conveyor means in order to transport the bill to the outlet.

14 Claims, 4 Drawing Sheets



U.S. Patent

May 30, 1995

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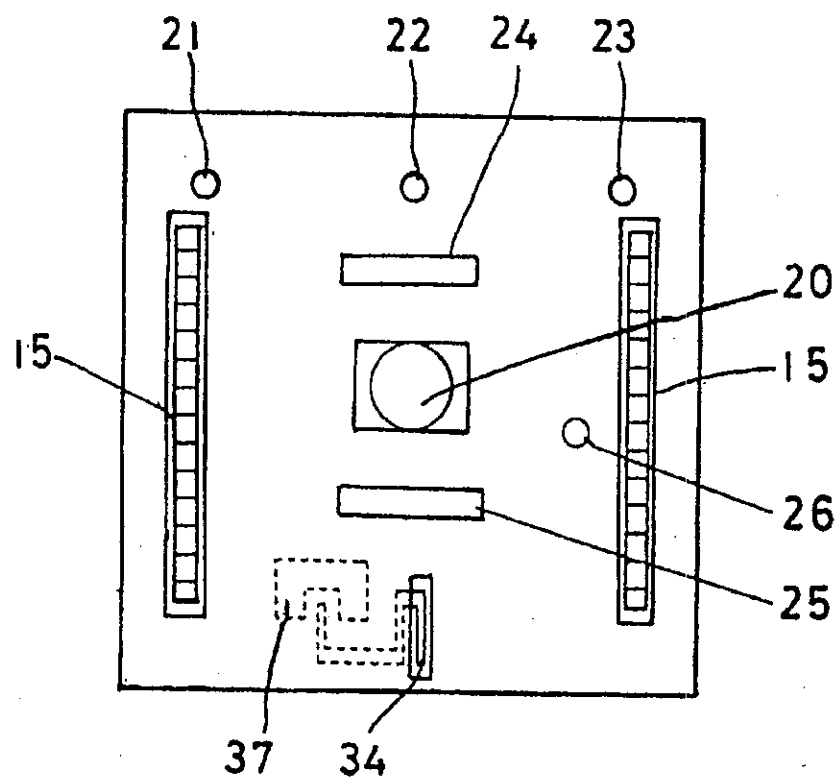


FIG. 2

U.S. Patent

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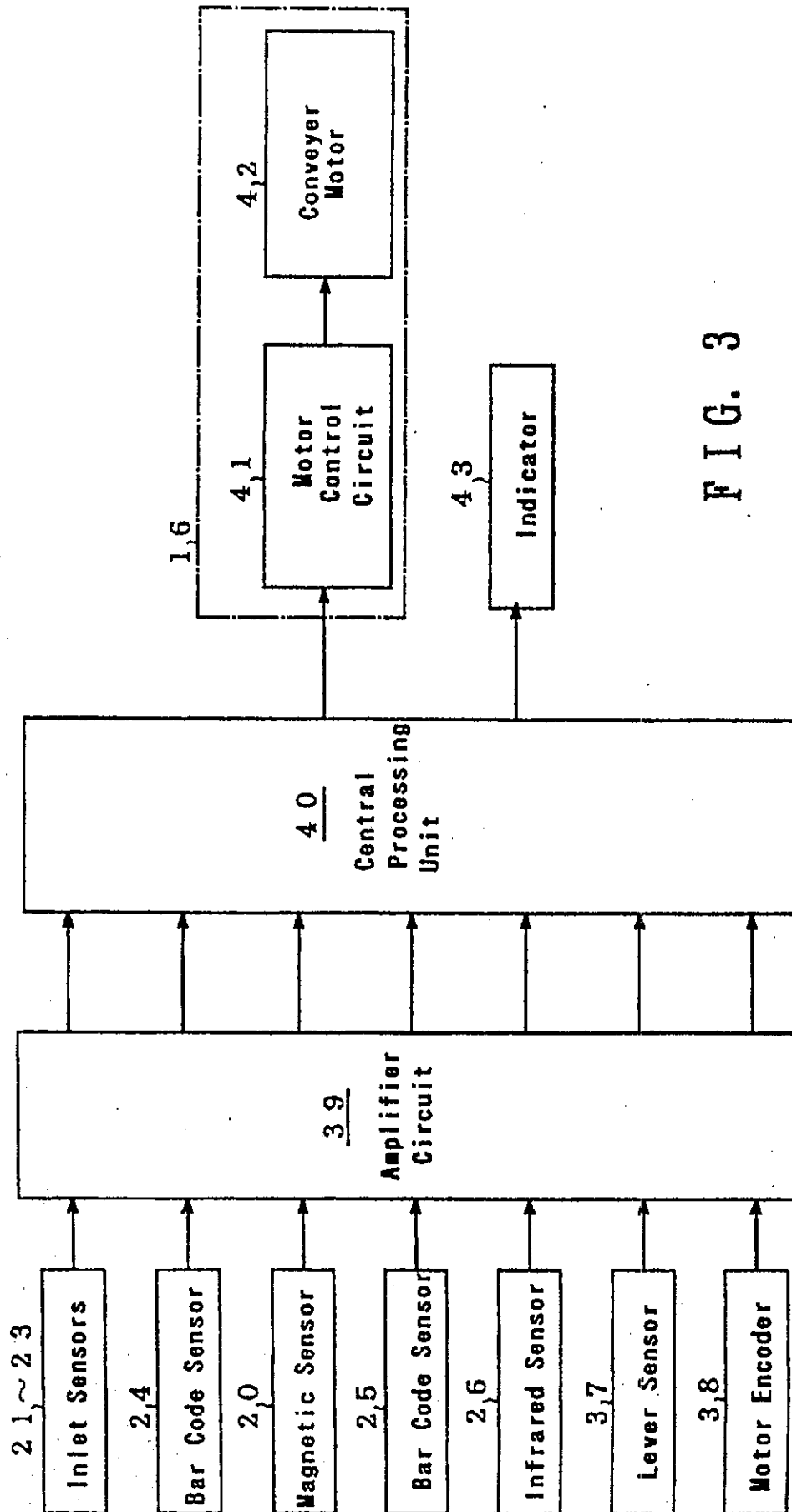


FIG. 3

U.S. Patent

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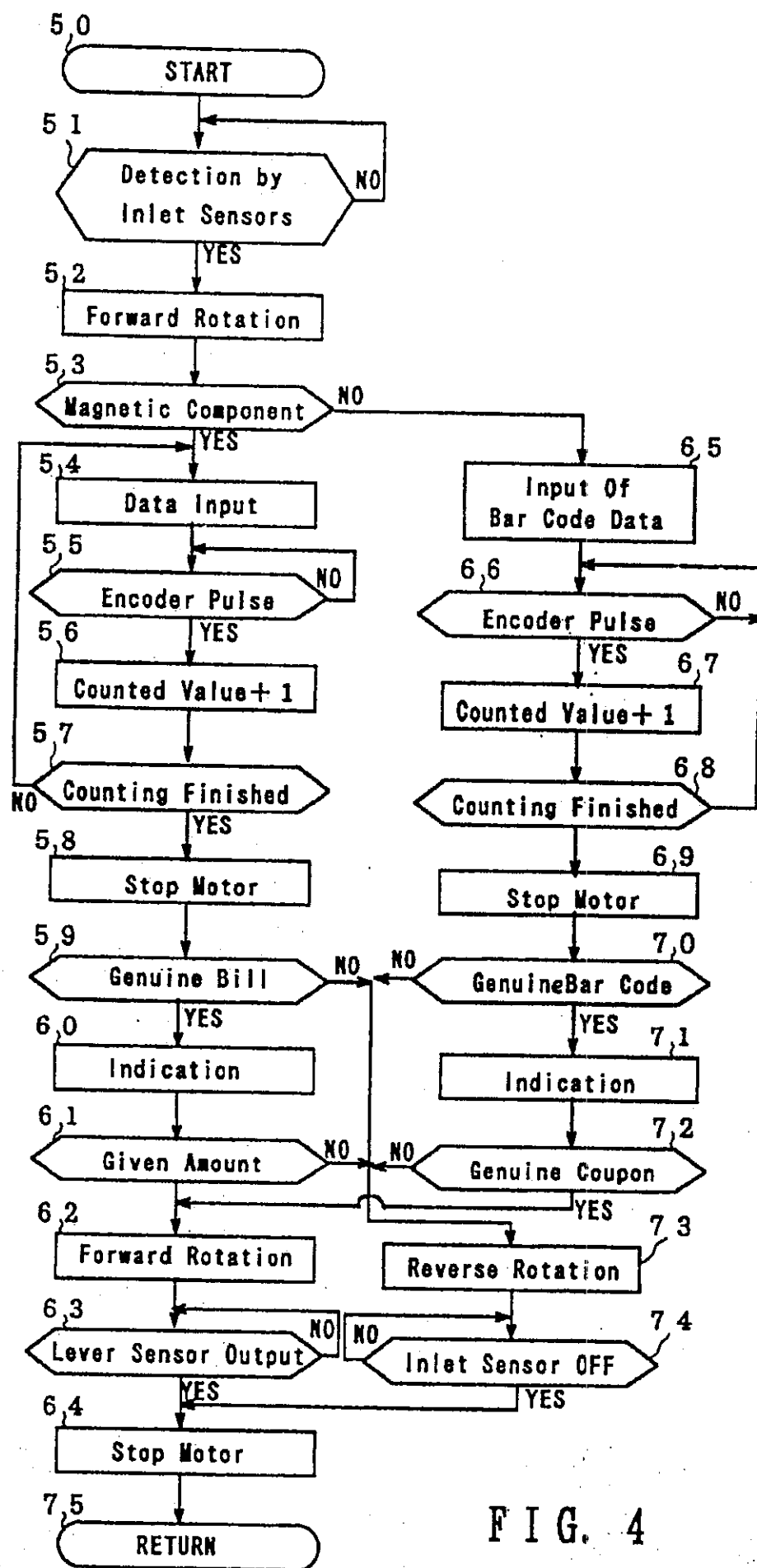


FIG. 4

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BILL VALIDATOR WITH BAR CODE DETECTOR**Background of the Invention****Field of the Invention**

This invention relates to a bill checker, in particular to an improvement of a bill validator capable of validating bills and bar codes printed on documents such as coupons, valuable securities or negotiable papers.

DESCRIPTION OF THE PRIOR ART

Gift certificates detectable by a bill sorter are known as shown by U.S. Pat. No. 4,659,126 to K. Kachi et al. Prior art gift certificates which may be discriminated by a bill validator, have letters and designs printed on a rectangular paper of its width passable within a passageway of the bill validator. The gift certificate is provided with first and second information rows detected by corresponding two magnetic heads equipped in the bill validator for detecting ferrous ink printed on bills. The first information row is printed to form information units at regular intervals in a line of the gift certificate with ferrous ink. The second information row is printed with ferrous ink in blank portions between information units of the first information row on the gift certificates to indicate an equivalent amount to money and names of exchangeable goods and other information necessary to the gift certificate.

Also, Japanese Patent Disclosure No. 59-82392 by T. Misawa discloses a vending machine which comprises an inlet for receiving a gift certificate, a processing unit for magnetically reading out data printed on the certificate and a control unit for generating a selling signal in response to data read out by the processing unit.

U.S. Pat. No. 4,916,295 to P. Chominski discloses a document detecting arrangement for detecting banknotes having magnetic properties, comprising transport means for transporting documents past a magnetic detector which includes a permanent magnet and magnetic circuit having detector means for detecting changes in the magnetic field through the magnetic circuit. An output of the detecting means is connected to a signal processing means for generating signals in response to the magnetic properties of bank notes transported through the arrangement.

U.S. Pat. No. 5,020,110 to P. Chominski shows an arrangement for examining bank-notes or similar documents including a detector such as CCD array of photocell devices. The documents are scanned by the photocell devices transversely of their longitudinal extent.

U.S. Pat. No. 5,091,634 describes coupon validation system for interpreting coupons each incorporating a bar code having a validation data and a message code. The system comprises a real time clock for maintaining a current date record, a memory for storing one or more winning number codes, apparatus for receiving a coupon presented to the system and in response reading the bar code, and a microcomputer for comparing the validation date with the current date record. When the current date record is not equal to the validation date, it rejects the coupon. When the current date record is equal to the validation date, it compares the one or more winning number codes with the message code. When they are equal, it generates a message for indicating that the coupon is a winner. When the one or more winning number codes and the message code are not

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equal, it generates an alternative message for indicating that the coupon is not a winner.

Japanese Patent Disclosure No. 53-33532 by V. Ponsio discloses an automatic validator utilizing an optical sensor to discriminate genuine and false coupons. The validator of this type comprises a memory for collection and storing "sample words" corresponding "sample coupons", means for transmitting the "sample words" to comparator memory means, means for optically scanning sectioned areas on a surface of a coupon to read out an optical feature thereof, converter means for converting the resulted signals from the scanning means to numeral data, microprocessor means for modifying the numeral data to a "word" and then for forwarding the word to the comparator memory means, and decision means for distinguishing genuine and false coupons. Japanese Patent Disclosure No. 60-220797 by K. Kachi et al. exhibits a discriminator device which detects by a magnetic head a series of information printed with ferrous ink on gift certificates. A series of the information includes indication of money amount or names of exchangeable goods printed on the gift certificates which also bear printed letters or design.

Since recent gift certificates bear bar code printed thereon for discrimination, it is necessary to validate gift certificates by automatically validating bar code printed thereon, however, no proposal has been made on a novel device which can validate both of bills and bar coded documents.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a bill validator which may validate both of bills and bar-coded documents.

Another object of the invention is to provide a bill validator which includes sensor means capable of detecting a magnetic feature of bills and an optical feature of bar coded documents.

A further object of the invention is to provide a bill validator which may validate bills and both surfaces of bar coded documents utilizing sensor means.

A still further object of the invention is to provide a bill validator which may validate bills and bar coded documents from permeation pattern of infrared ray through the bills and reflection pattern of light on surfaces of the documents.

The bill validator in accordance with the present invention includes conveyor means for transporting a bill inserted from an inlet to an outlet along a passageway; sensor means positioned in vicinity of the passageway for detecting magnetic or optical feature of the bill; and discriminator means for receiving signals from the sensor means to generate outputs in order to drive the conveyor means when the discriminator means detects a predetermined magnetic or optical pattern for a genuine bill. The discriminator means comprises a bar code detector for photoelectrically converting bar code pattern printed on a document inserted into the inlet into electric signals; a bar code memory for storing predetermined bar code patterns; an bar code comparator for comparing bar code signals read out through the bar code sensor with bar code signals stored in the bar code memory after or before the discriminator means decides whether the document is a genuine bill or not. The bar code comparator generates a drive signal to the conveyor means to transport the document to the outlet when the bar code comparator detects coincidence of the bar code signals from the sensor means and bar code

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memory. The sensor means includes magnetic and optical sensors positioned in vicinity of the passageway for detecting magnetic and optical features of the bill; and infrared sensor which generates permeation pattern of infrared ray passing through the documents. Some of the optical sensors are positioned adjacent to the inlet or the bill validator. The discriminator means includes a ferrous detector for receiving outputs of the magnetic sensor to detect ferrous component of the bill. The bar code detector includes two bar code sensors positioned in parallel relation to each other for detecting bar code printed on one or both of the front and back surfaces of the document.

The discriminator means includes a bill memory for storing predetermined magnetic or optical patterns; a bill comparator for comparing magnetic or optical signals read out through the sensor means with bill pattern signals stored in the bill memory, the bill comparator generating a drive signal to the conveyor means to transport the bill to the outlet when the bill comparator detects coincidence of the bill pattern signals from the sensor means and bill memory. The optical sensor produces outputs which are used for validation of a bill. The bar code memory and the bar code comparator are provided in the discriminator means. The discriminator means detects bar code after or before detection of whether or not the document is a genuine bill. A motor encoder is provided to generate pulses in order to detect exact position of the document within the passage. Means may be provided to invalidate the document which is considered not valid. The sensor means includes at least an inlet signal capable of detecting overlapped bills from the amount of light passing through the bill. Accordingly, the bill validator of the present invention can discriminate both of bills and bar code documents for validation.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view of a bill validator according to the present invention;

FIG. 2 is a plan view of the bill validator removing an upper frame thereof;

FIG. 3 is an electric circuit for electrically driving the validator of FIG. 1; and

FIG. 4 is a flow chart indicating an operating sequence of the electric circuit of FIG. 3.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1 through 4, an embodiment of a bill validator according to the present invention will be described as follows:

The instant invention may be applied to a bill handling apparatus such as vending machines and bill exchangers. As shown in FIG. 1, the bill handling apparatus comprises a bill validator 10 and a stacker 11 mounted on the bill validator to connected therewith by a passageway 13 to transport a bill to be inserted from an inlet 12 to an outlet 14. The bill validator 10 has upper and lower frames 31 and 30 which support conveyor means 16 and a plurality of sensors. The passageway 13 is defined by the conveyor means 16 which includes a pair of conveyor belts 15 (FIG. 2) wound around a pair of drive pulleys 17.

The bill validator 10 is equipped with a magnetic sensor 20 of a magnetic head or Hall IC mounted in vicinity of the passageway 13 to detect ferrous ink printed in predetermined positions of bills. As shown in

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FIG. 2, mounted on the frames 30 and 31 are three inlet sensors 21 to 23, bar code sensors 24 and 25 and infrared sensor 26 each of which is a photo-coupler including a light emitting diode (LED) and a light receiving transistor (LRT) so that the photo coupler photoelectrically converts into electric signals light which is reflected on or passed through a bill or a document. By measuring amount of light passed through the bill, overlapped bills of thickness of a bill inserted into the inlet 12 may be detected. The inlet sensors 21 to 23 are positioned adjacent to the inlet 12 to emit from LEDs of the sensors 21 to 23 infrared ray which then passes through a bill so that permeation pattern of infrared ray through bills is detected by LRTs of the inlet sensors 21 to 23. For instance, the inlet sensor 22 of FIG. 2 is composed of a LED 22a secured to a lower frame 30 of the validator 10 and a LRT 22b secured to an upper frame 31. The upper frame 31 is pivotally attached to the lower frame 30 by a shaft (not shown) to open the upper frame 31 and easily remove jammed bills within the passageway 13. Mounted on the lower frame 30 is the bar code sensor 24 which has a LED to emit a light beam toward a back surface of a document within the passageway and a LRT to receive the light beam from the LED reflected on the back surface of the bill. A similar bar code sensor 25 having a LED and a LRT is provided on the upper frame 31 in parallel relation to the bar code sensor 24 so that the LED of the bar code sensor 25 emits a light beam toward a front surface of the document within the passageway and the LRT of the bar code sensor 25 receives the light beam reflected on the front surface of the bill. Accordingly, the bar code sensors 24 and 25 optically detect bar code printed on either of one of the front and back surfaces of bills. An infrared sensor 26 has a LED 26a secured to the lower frame 30 and a LRT 26b secured to the upper frame 31 so that infrared ray emitted from the LED 26a passes through the bill and then is received by the LRT 26b to detect position and passage of the bill from the resulted permeation pattern of infrared ray. A pusher roller 27 urges the bill or document toward the magnetic sensor 20. Rollers 32, 33 are rotatably mounted on the upper frame 31 to urge the bill document toward the conveyor belts 15 wound around the drive pulleys 17. A lever 34 is rotatably mounted by a shaft 35 to the lower frame 30 at the rear of the bar code sensor 25 to detect passage of the bill or document. One end of the lever 34 is connected with a tension spring 36 attached to the lower frame 30 so that the other end of the lever 34 is resiliently urged to project within the passageway 13. Traveling along the passageway 13, the bill or document forces the lever 34 to rotate in a clockwise direction against resilient force of the spring 36 during contact between the other end of the lever 34 and the bill or document so that it can pass the lever 34. A lever sensor 37 of a photocoupler optically detects one end of the rotated lever 34 when the bill passes the lever 34.

As shown in FIG. 3, the magnetic sensor 20, inlet sensors 21 to 23, bar code sensors 24, 25 and infrared sensor 26, and lever sensor 37 are connected with corresponding input terminals of a central processing units (CPU) 40 which has output terminals respectively connected with a motor control circuit 41 of the conveyor means 16 and an indicator 43. The motor control circuit 41 produces outputs to energize a conveyor motor 42 which is drivinly connected with the drive pulleys 17. The indicator 43 has light emitting diodes or liquid

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crystal to represent money amount of kind of the validated bill and bar code data.

The CPU 40 is composed of a one-chip-microcomputer and discrete ICs or circuits which not shown but comprises discriminator means connected with inlet sensors 21 to 23, bar code sensors 24, 25, infrared sensor 26, lever sensor 37 and motor encoder 38 to generate outputs to drive the conveyor means 16 in response to the signals from inlet sensors 21 to 23, bar code sensors 24, 25, infrared sensor 26, lever sensor 37 and motor encoder 38. The motor encoder 38 electromagnetically or photoelectrically produces electric pulses in response to rotated angles of the motor so that the CPU 40 exactly detects the position of the inserted bill by counting pulses from the motor encoder 38 regardless of rotating rate of the motor. The CPU 40 includes a counter for counting the pulses generated by the motor encoder 38 after the outputs of the inlet sensors 21 to 23 occurs until the lever sensor 37 generates its output or until the inlet sensors 21 to 23 cease generation of their outputs of sensing the bill or document. The discriminator means include a ferrous detector for receiving outputs of the magnetic sensor 20 to detect ferrous component of ink printed in predetermined positions of the bill; a magnetic pattern memory for storing predetermined magnetic patterns; an bar code comparator for receiving outputs of the bar code sensors 24, 25 to detect bar code printed on a document; and bar code memory for storing predetermined bar code patterns. The bar code comparator compares bar code signals read out through bar code sensors 24, 25 from the document with bar code signals stored in the bar code memory. Ferrous ink and bar code are printed in predetermined positions of bills or coupons so that positions of ferrous ink and bar code are easily detected by counting pulses generated by the motor encoder 38 as the number of the counted pulses indicates exact position of the bill or document in the passageway 13. When the bar code comparator detects coincidence of the bar code signals from the bar code sensors 24, 25 and bar code memory, it generates coincident signal to supply a drive signal to the motor control circuit 41 of the conveyor means 16 in order to transport the bill to the outlet 14.

In use, the CPU 40 is operated in accordance with an operating sequence shown in a flow chart of FIG. 4.

The inlet sensors 21 to 23 detect a bill or bar coded document inserted into the inlet 12 and generate detection signals to the CPU 40 which then supplies the motor control circuit 41 with drive signals to rotate the conveyor motor 42 in the forward direction as shown in Steps 50 to 52 of FIG. 4. Thus, the drive pulleys 17 of the conveyor means 16 are driven in the clockwise direction in FIG. 1 so that the conveyor belt 15 is driven and the bill is moved toward the magnetic sensor 20. Then in Step 53, the CPU 40 decides whether or not the magnetic sensor 20 detects the ferrous component on the bill. When the magnetic sensor 20 detects the ferrous component on the bill, the CPU 40 determines that the document inserted into the inlet 14 is a bill. Then, in step 54, the CPU 40 receives outputs as data of the inserted bill from the magnetic sensor 20 and inlet sensors 21 to 23. The magnetic sensor 20 forwards a plurality of signals derived from the ferrous material of the bill to a bill memory of the CPU 40 which then stores these data.

In Step 55, the CPU 40 decides whether to receive pulses of the motor encoder 38 generated with rotation of the motor to detect exact position of the bill passing

within the passageway 13. The counter of the CPU 40 counts the number of pulses from the motor encoder 38, adding one to the counted value of pulses (Step 56) in the counter each time detecting one pulse from the motor encoder 38. In Step 57, the CPU 40 judges whether or not the counter reaches a predetermined counted value, and when the counter does not reach the predetermined counted value, the processing returns to Step 54. When the counter reaches the predetermined counted value, the processing moves to Step 58 from 57 to finish the counting of pulses. In Step 58, the CPU 40 ceases drive signals to the conveyor motor 42 to stop operation of the conveyor motor 42, and subsequently the bill comparator of the CPU 40 compares the received magnetic detection signals with the predetermined magnetic patterns stored in the magnetic pattern memory to determine whether or not these patterns are coincident and thereby to determine whether the inserted bill is genuine or not (Step 59). After detection of the genuine bill in Step 59, the CPU 40 also decides a kind of bills or money amount from the detected magnetic pattern, and as a result forwards to signals to the indicator 43 which therefore indicates the kind of the bill or money amount (Step 60).

In Step 61, the CPU 40 determines whether or not the bill is a predetermined one of money kinds. When the bill is one of the predetermined money kinds, the conveyor motor 42 is further driven in the forward direction in Step 62. When the bill passes through the lever 34, the lever sensor 37 detects the end of the rotated lever 34 and in Step 63 generates an output which the CPU 40 receives. After the bill has passed through the lever 34, the CPU 40 ceases outputs to stop operation of the conveyor motor 42 from Step 64 to 75.

When the inserted bill is not genuine in Step 59 or when the bill is not any one of the predetermined money kinds in Step 61, the processing is moved to Step 73 wherein the CPU 40 drives the conveyor motor 42 in the reverse direction, and the bill is returned to the inlet 14. When the inlet sensors 21 to 23 detect nother in Step 74, operation of the conveyor motor 42 is stopped in Step 64, and then the processing moves to Step 75.

When ferrous component is not detected from the inserted bill in Step 53, the CPU 40 decides a bar coded coupon not a bill. During further rotation of the conveyor motor 42, the CPU 40 receives bar code data from the bar code sensor 24 or 25 in Step 65. In this stage, the CPU 40 decides whether to receive encoder pulses generated with rotation of the conveyor motor 42 in Step 66. Similarly to Step 56, the counter of the CPU 40 counts number of the pulses from the motor encoder 38, adding 1 to the counted value each time of detecting one encoder (Step 67). In step 68, the CPU 40 judges whether or not the counter reaches a predetermined counted value, and when the counter does not reach the predetermined counted value, the processing returns to Step 66. When the counter reaches the predetermined counted value, the processing moves to Step 69 from 68 to finish the counting of pulses. In Step 69, operation of the conveyor motor 42 is stopped, and subsequently bar code comparator of the CPU 40 compares the received bar code signals with the predetermined bar code patterns stored in the bar code pattern memory to determine whether or not these patterns are coincident thereby determine whether the bar code is genuine or not (Step 70). When the CPU 40 decides that the bar code is genuine, the bar code data is indicated by the indicator 43 (Step 71). Also, the CPU 40 detects infra-

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red permeation pattern of the coupon forwarded from the inlet sensors 21 to 23 and compares the infrared permeation pattern of the coupon with a pattern stored in a pattern memory to determine whether or not the coupon is genuine. When the CPU 40 decides that the infrared permeation pattern agrees with the stored pattern, the coupon is considered genuine, and processing is moved from Step 72 to 62. When the CPU 40 decides that bar code is not genuine in Step 70 or that the coupon is not genuine in Step 72, processing is moved to Step 73. In this way, the bill validator of the invention can discriminate both of bills and bar coded documents.

The mode of the embodiment of the present invention may be varied apart from the foregoing embodiment. An additional means may be provided for discriminating genuine or false of the bill in Step 59 of FIG. 4 by detecting infrared permeation pattern of the bill obtained from the inlet sensors 21 to 23 in addition to the magnetic detection pattern derived from the magnetic sensor 20. In lieu of checking of bar code after detection of magnetic component by the magnetic sensor 20 from the bill, the bill may be checked after checking of bar code. In the foregoing embodiment, bills and coupons are stacked in the same stacker 11, but otherwise may be stacked in different stackers after dividing the bills and coupons into different passageways at the outlet 14 by a suitable sorter means. The bill validator 10 may include means for invalidating documents which are considered not valid by the bar code comparator so that the invalidating means includes a printer for printing black on bar code of the invalidated document or means for cutting same.

What is claimed is:

1. A bill validator, comprising:
 a conveyor means for transporting a bill inserted from an inlet to an outlet along a passageway;
 a sensor means positioned in the vicinity of said passageway for detecting a magnetic or optical feature of the bill;
 a bar code detector means for photoelectrically converting bar code pattern printed on a document inserted into said inlet into electric signals, said bar code detector means connected with a discriminator means;
 said discriminator means for receiving signals from said sensor means to generate outputs in order to drive said conveyor means when said discriminator means detects a predetermined magnetic or optical pattern for a genuine bill, wherein said discriminator means comprises a bar code memory for storing predetermined bar code patterns and a bar code comparator for comparing bar code signals read out through said bar code detector means with bar code signals stored in said bar code memory, after or before said discriminator means decides whether said document is a genuine bill, said bar code comparator generating a drive signal to said conveyor means to transport said document to said outlet

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when said bar code comparator detects coincidence of said bar code signals from said sensor means and bar code memory.

2. The bill validator of claim 1 wherein said sensor means includes magnetic and optical sensors positioned in vicinity of said passageway for detecting magnetic and optical features of the bill.

3. The bill validator of claim 1 wherein said sensor means includes infrared sensor which generates permeation pattern of infrared ray passing through said documents.

4. The bill validator of claim 1 wherein said sensor means includes optical sensors positioned adjacent to said inlet of the bill validator.

5. The bill validator of claim 2 wherein said discriminator means includes a ferrous detector by receiving outputs of said magnetic sensor to detect ferrous component of said bill.

6. The bill validator of claim 1 wherein said bar code detector includes two bar code sensors positioned in parallel relation to each other for detecting bar code printed on one or both of front and back surfaces of said document.

7. The bill validator of claim 1 wherein said discriminator means includes a bill memory for storing predetermined magnetic or optical patterns;

a bill comparator for comparing or optical signals read out through said sensor means with bill pattern signals stored in said bill memory, said bill comparator generating a drive signal to said conveyor means to transport said bill to said outlet when said bill comparator detects coincidence of said bill pattern signals from said sensor means and bill memory.

8. The bill validator of claim 1 wherein said optical sensor produces outputs which are used for validation of a bill.

9. The bill validator of claim 1 wherein said bar code memory and said bar code comparator are provided in said discriminator means.

10. The bill validator of claim 1 wherein said discriminator means detects bar code detection of whether or not the document is a genuine bill.

11. The bill validator of claim 1 wherein said discriminator means detects bar code detection of whether or not the document is a genuine bill.

12. The bill validator of claim 1 further comprising a motor encoder for generating pulses to detect exact position of said document within said passage.

13. The bill validator of claim 1 further comprising means for invalidating said document which is considered not valid.

14. The bill validator of claim 1 wherein said sensor means includes at least an inlet sensor capable of detecting overlapped bills from the amount of light passing through the bill.

* * * * *

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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 5,420,406

Page 1 of 4

DATED : May 30, 1995

INVENTOR(S) : HIKARU IZAWA ET AL.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the Cover Page, in the Abstract, line 5, before "bar code" --a-- should be inserted, and on line 20, "meter control" should read --motor control--.

In Column 1, line 14, "4,659,126" should read --4,658,125--.

In Column 1, line 16, change "validtor" to read --validator--.

In Column 1, line 23, after "line" change "of" to read --on--.

In Column 1, line 24, change "terrous" to read --ferrous--.

In Column 1, line 26, change "certificates" to read --certificate--.

In Column 1, line 35, change "date" to read --data--.

In Column 1, line 54, change "data" to read --date--.

In Column 1, line 57, change "wining" to read --winning-- and after "number codes" delete the "." and insert a --,--.

In Column 1, lines 57-58, delete "couponig" and insert --coupon--.

In Column 1, line 65, change "wining" to read --winning--.

In Column 1, line 68, change "wining" to read --winning--.

In Column 2, line 7, change "collection" to read --collecting--.

In Column 2, line 49, change "outlet" to read --inlet--.

In Column 3, line 6, after "inlet" change "or" to read --of--.

In Column 3, line 12, delete "the".

**UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION**

PATENT NO. : 5,420,406

Page 2 of 4

DATED : May 30, 1995

INVENTOR(S) : HIKARU IZAWA ET AL.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In Column 3, line 31, change "valide" to read --valid--.

In Column 3, line 32, change "signal" to read --sensor--.

In Column 3, line 35, change "code" to read --coded--.

In Column 3, line 57, change "to" to read --10--.

In Column 3, line 67, change "ferruos" to read --ferrous--.

In Column 4, line 9, before "thickness" change "of" to read --or--.

In Column 4, line 30, change "LRI" to read --LRT--.

In Column 4, line 34, after "either" change "of" to read --or--.

In Column 4, line 43, after "bill" insert --or--.

In Column 4, line 55, change "pas" to read --pass--.

In Column 4, line 59, after "sensor 20," delete "in".

In Column 4, line 62, change "units" to read --unit--.

In Column 4, line 67, change "drivinly" to read --drivingly--.

In Column 5, line 1, after "amount" change "of" to read --or--.

In Column 5, line 21, change "th" to read --the--.

In Column 5, line 48, change "supplis" to read --supplies--.

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 5,420,406

Page 3 of 4

DATED : May 30, 1995

INVENTOR(S) : HIKARU IZAWA ET AL.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In Column 5, line 68, change "exack" to read --exact--.

In Column 6, line 5, after "encoder" delete "30" and insert --38--.

In Column 6, line 12, change "steop" to read --stop--.

In Column 6, line 40, change "nother" to read --nothing--.

In Column 6, line 53, after "encoder" insert --pulse--.

In Column 6, line 64, change "patters" to read --patterns--.

In Column 6, line 65, change "genuin" to read --genuine--.

In Column 7, line 22, change "bilfl" to read --bill--.

In Column 8, claim 5, line 16, delete "by" and insert --for--.

In Column 8, claim 7, line 27, after "comparing" insert --magnetic--.

In Column 8, claim 11, line 46, after "code" insert --before--.

In Column 8, claim 13, line 52, after "which" delete "i" and insert --is--.

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 5,420,409
DATED : May 30, 1995
INVENTOR(S) : HIKARU IZAWA ET AL

Page 4 of 4

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In Column 8, claim 13, line 52, after "which" delete "i" and insert ~~is~~.

Signed and Sealed this
Seventeenth Day of October, 1995

Attest:



BRUCE LEHMAN

Attesting Officer

Commissioner of Patents and Trademarks

EXHIBIT 2



US005372361A

United States Patent [19]

Isobe et al.

[11] **Patent Number:** 5,372,361[45] **Date of Patent:** Dec. 13, 1994[54] **BILL HANDLING APPARATUS WITH EXCHANGEABLE PUSHER FOR STACKER**[75] **Inventors:** Atsushi Isobe; Masanobu Fujita, both of Kawasaki; Taichi Sato, Atsugi; Takayuki Takeda, Kanagawa, all of Japan[73] **Assignee:** Japan Cash Machine Co. Ltd., Osaka, Japan[21] **Appl. No.:** 152,294[22] **Filed:** Nov. 15, 1993[30] **Foreign Application Priority Data**

Nov. 13, 1992 [JP] Japan 4-078207[U]

Nov. 27, 1992 [JP] Japan 4-081980[U]

[51] **Int. Cl.⁵** B65H 29/00[52] **U.S. Cl.** 271/181; 271/198; 271/213; 194/203[58] **Field of Search** 271/3, 177, 180, 181, 271/198, 213, 219; 194/203[56] **References Cited****U.S. PATENT DOCUMENTS**

4,809,966 3/1989 Kobayashi et al. 271/181

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5,103,725	4/1992	Sugimoto et al.	271/213
5,195,739	3/1993	Watabe	271/181
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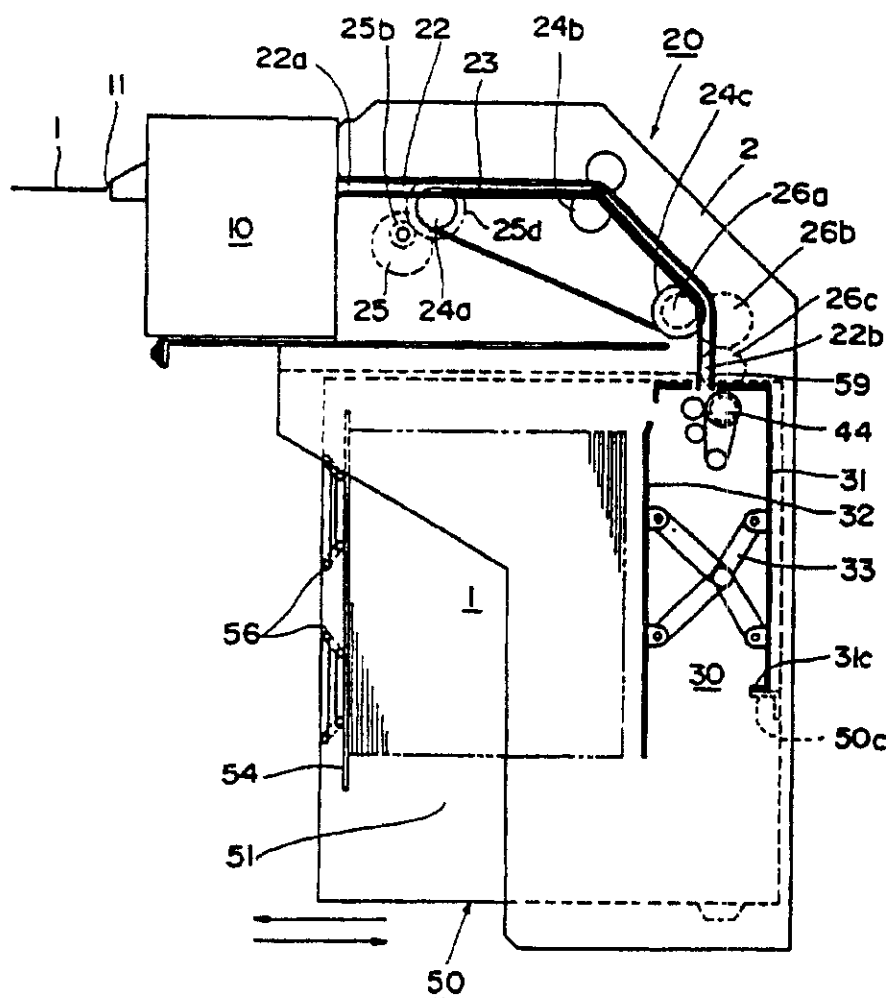
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Primary Examiner—H. Grant Skaggs*Attorney, Agent, or Firm*—Bachman & LaPointe[57] **ABSTRACT**

A casing of a stacker is provided with an opening and a chamber for disposing a pusher within the casing adjacent to the opening so that the pusher can be removably attached within the stacker. Also provided in the pusher is a slit-shaped inlet connected with an exit of a passageway within a transporter. By removing the pusher from the stacker and attaching same to another stacker having its compartment of different capacity, bill storing capacity may easily be changed. In malfunction of the pusher, it may easily be exchanged with new one for easy maintenance.

9 Claims, 10 Drawing Sheets



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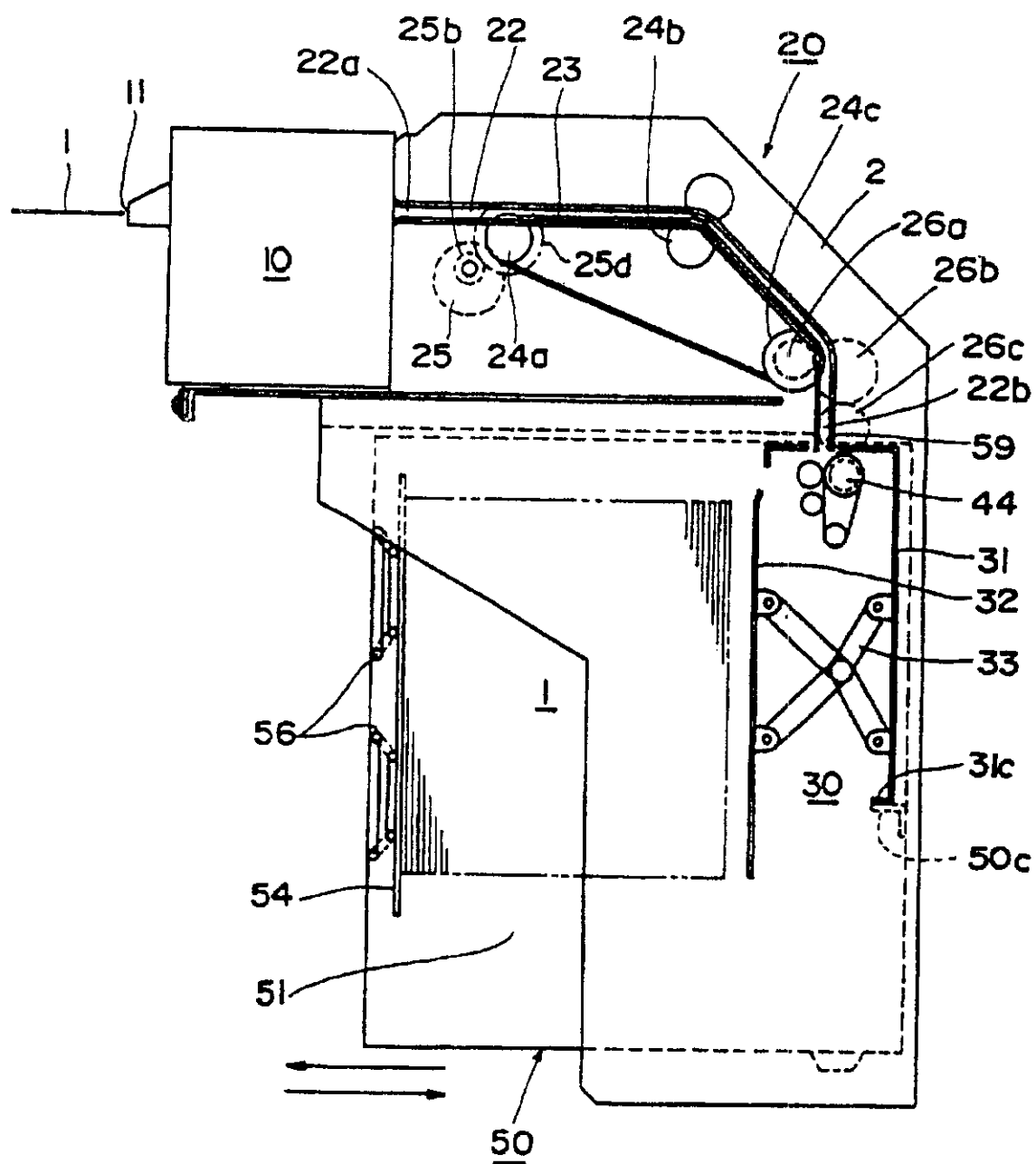


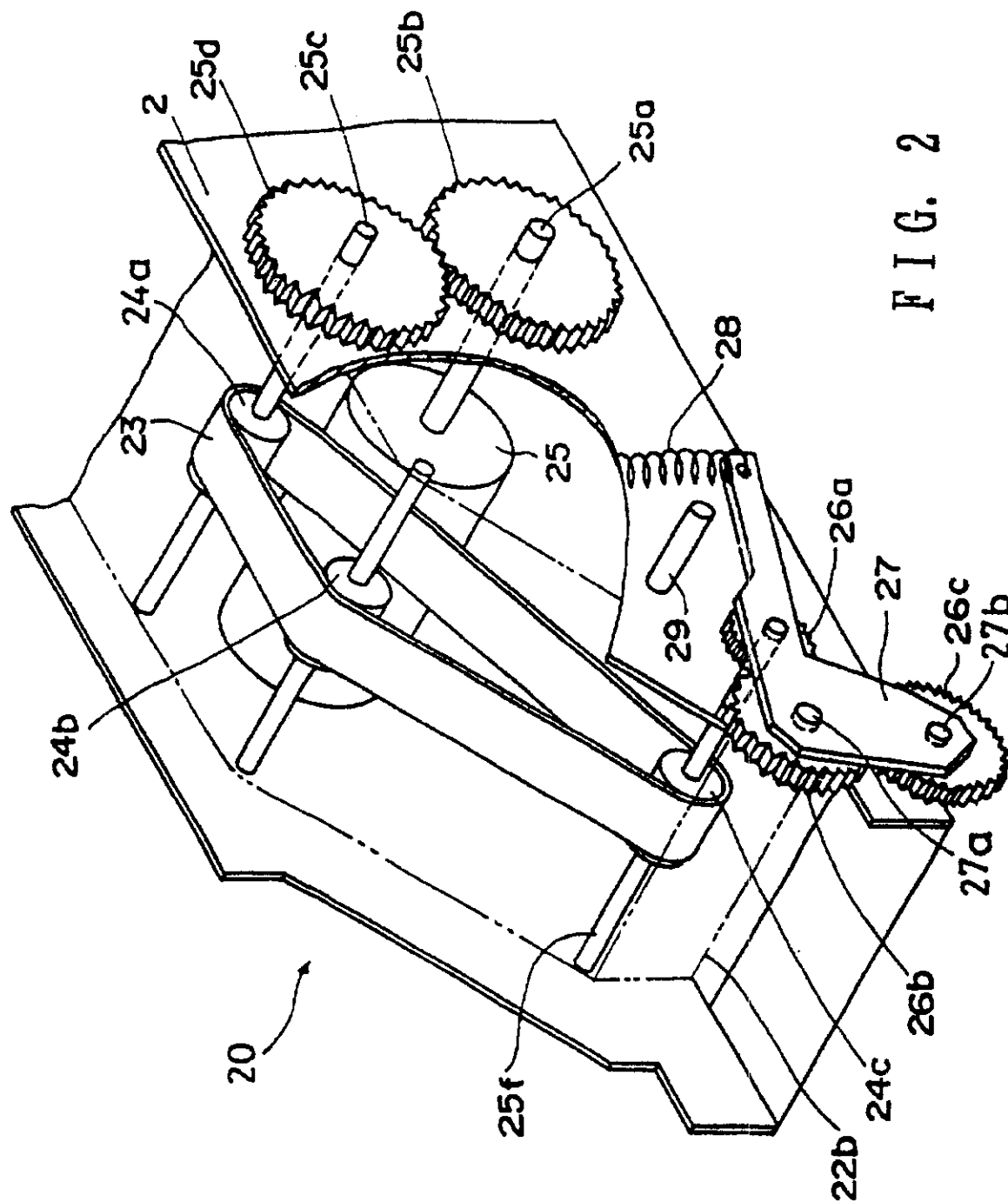
FIG. 1

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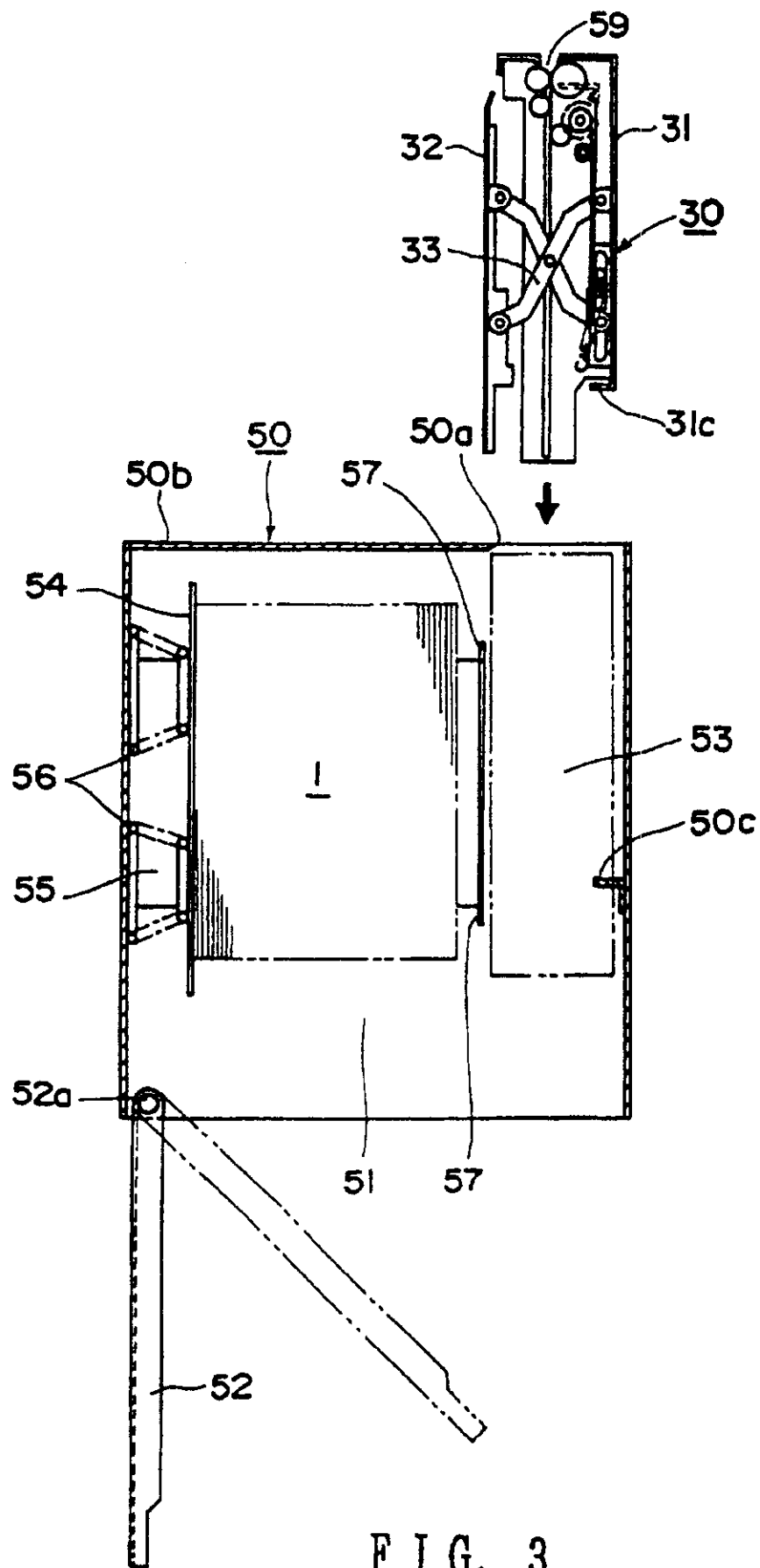


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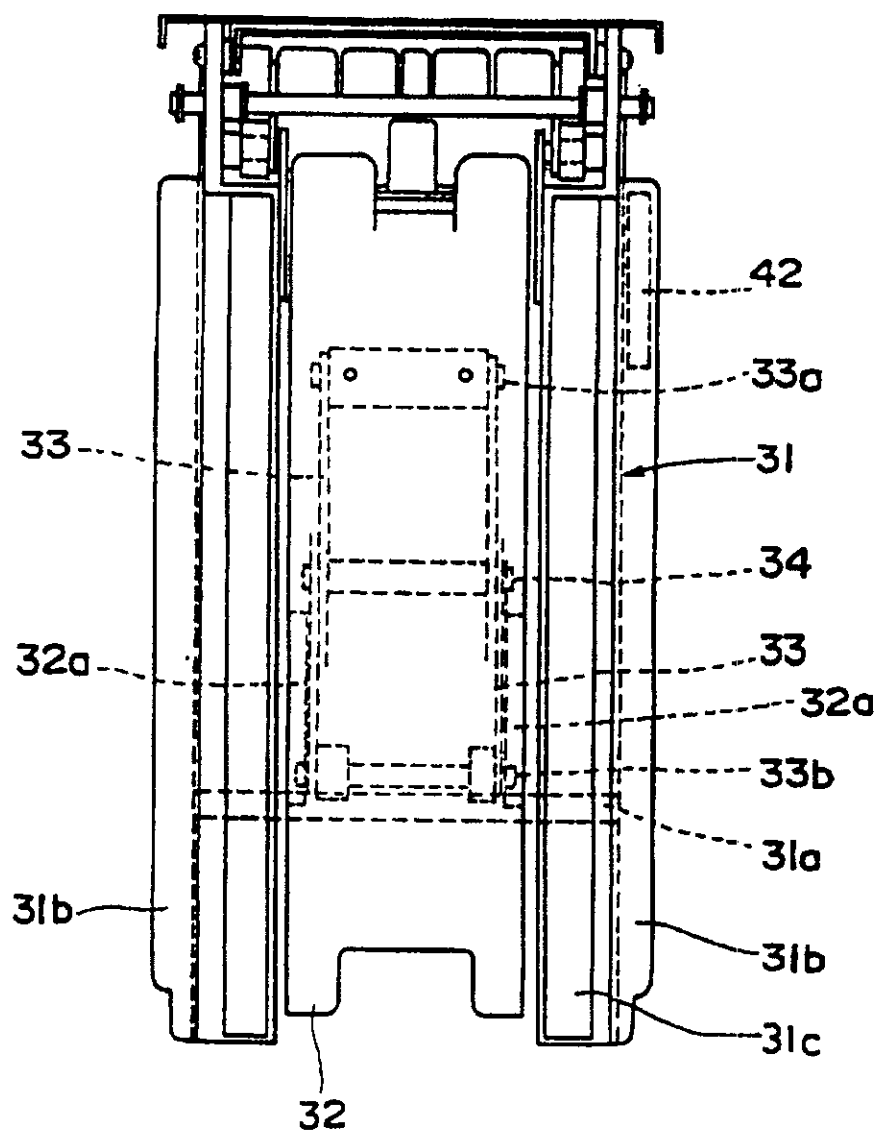


FIG. 5

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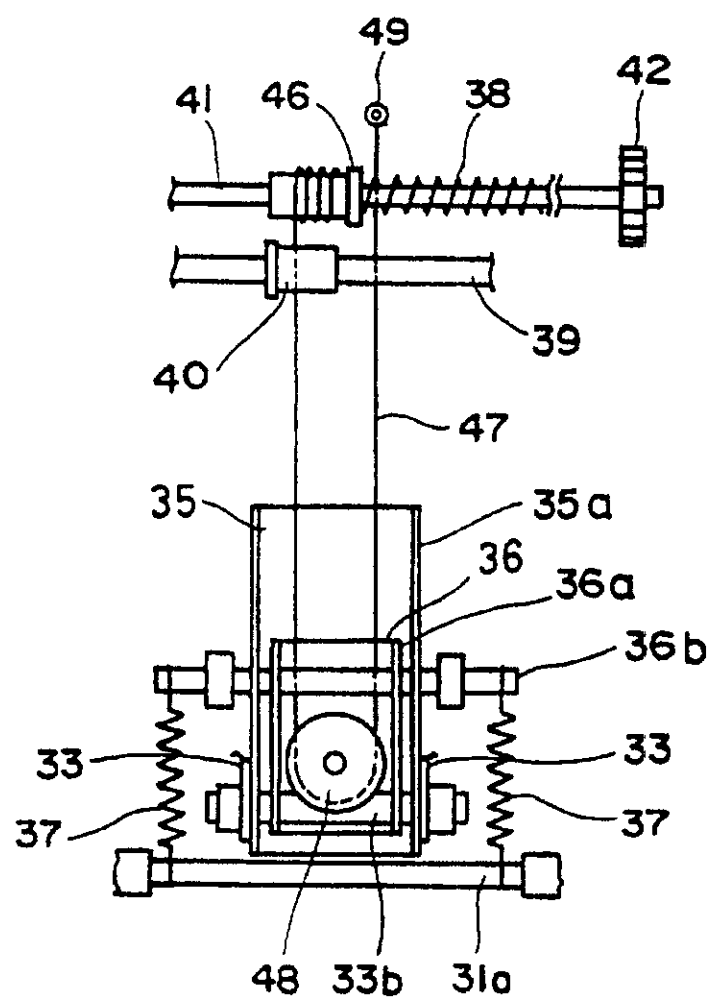


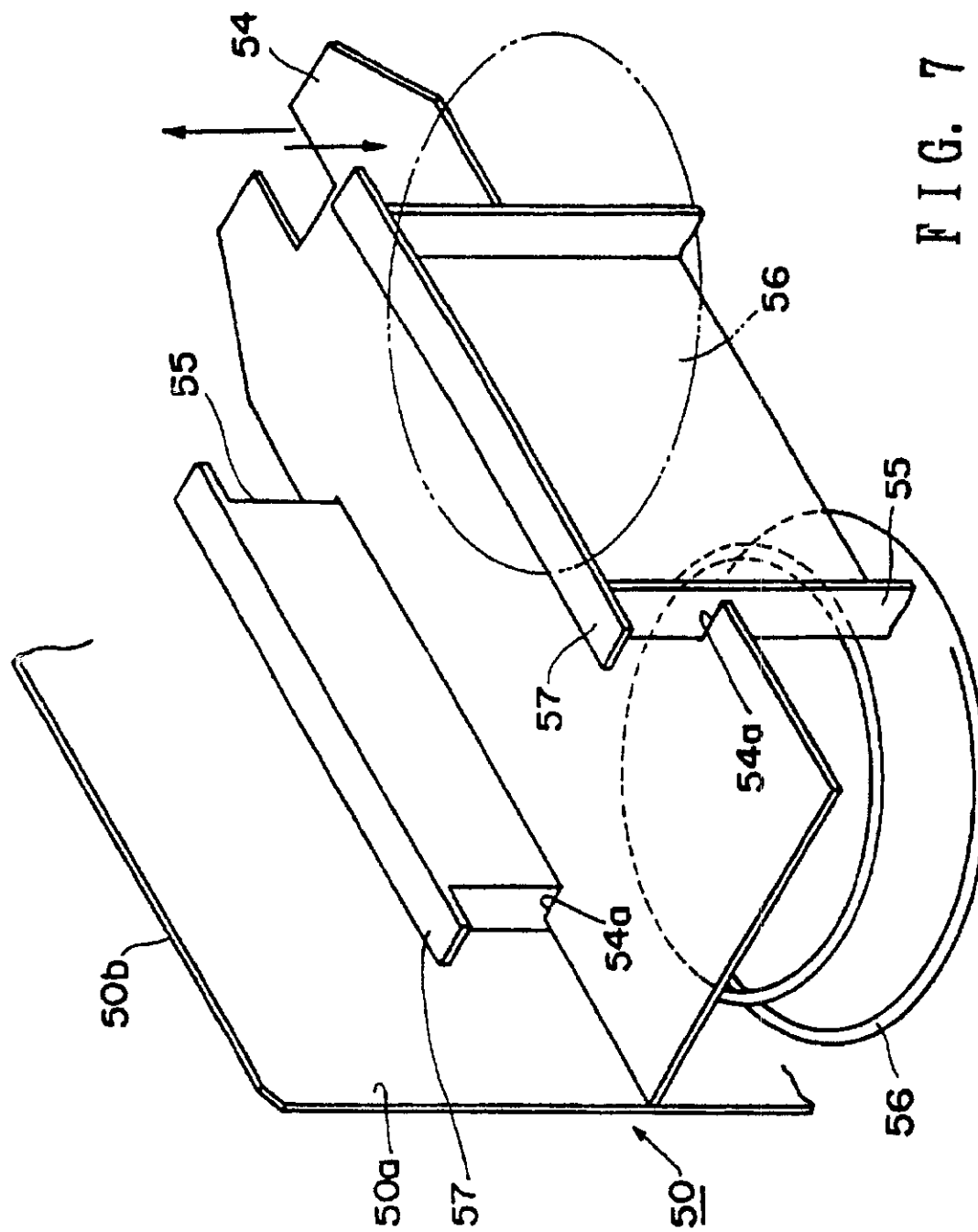
FIG. 6

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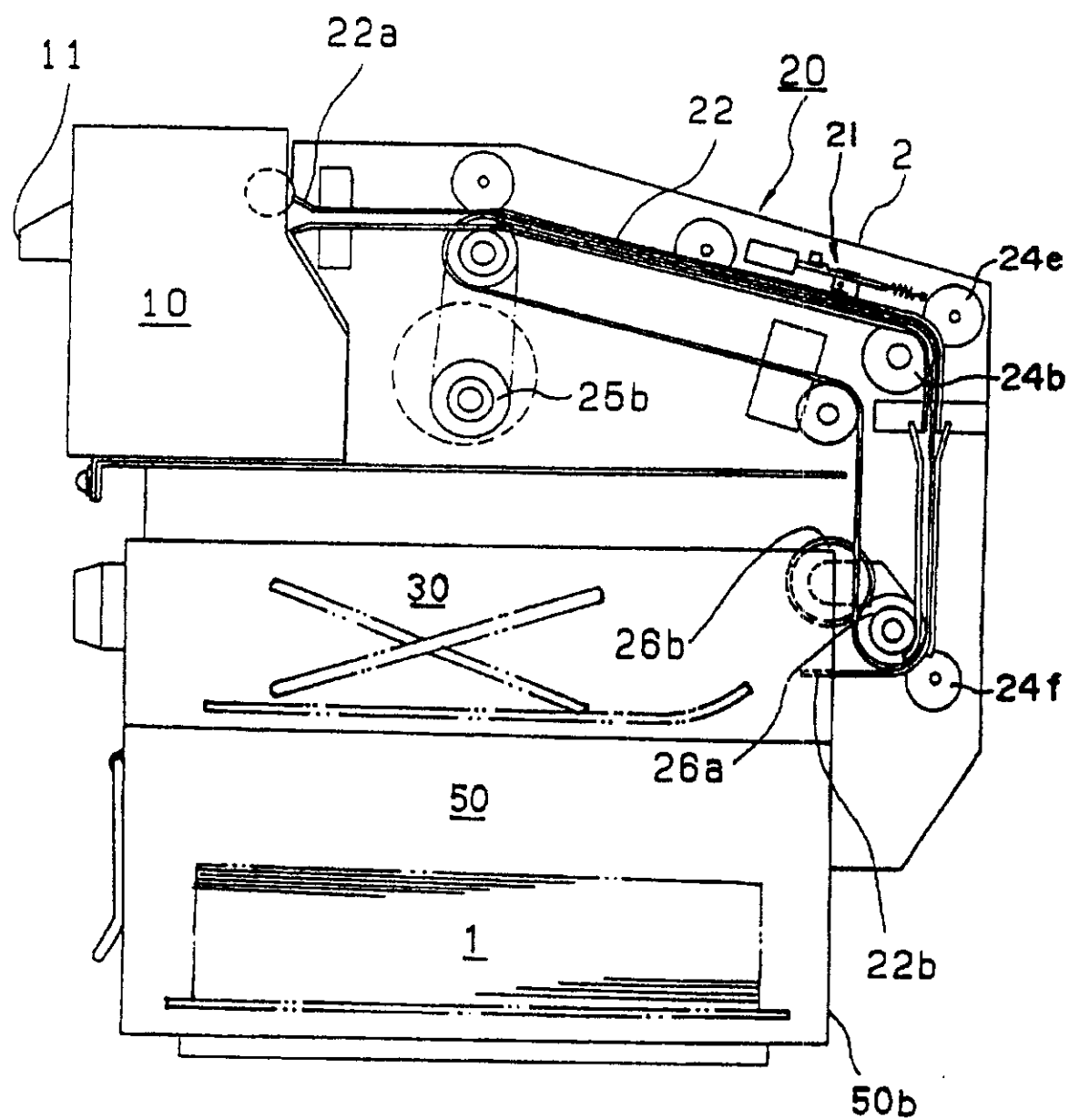


FIG. 8

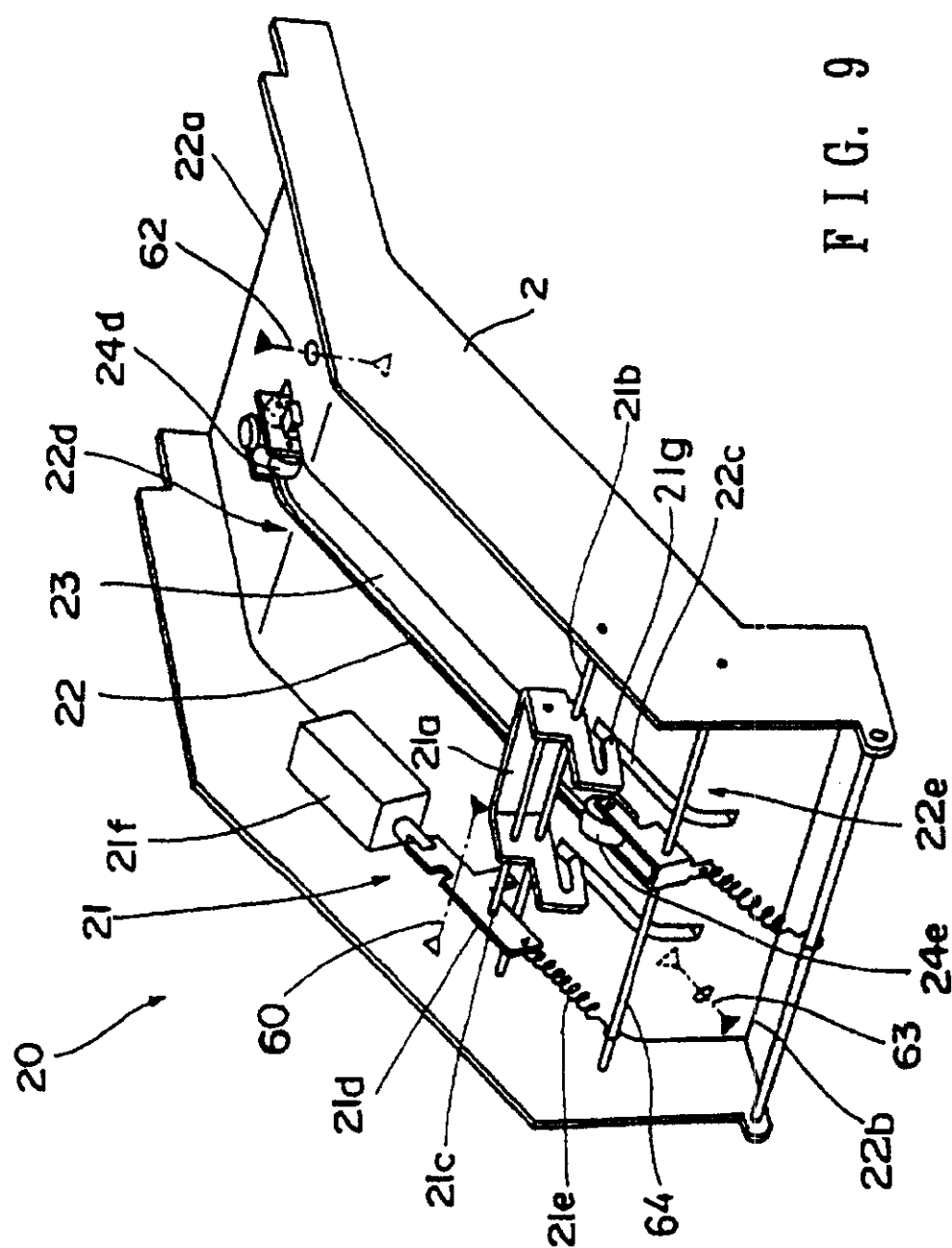


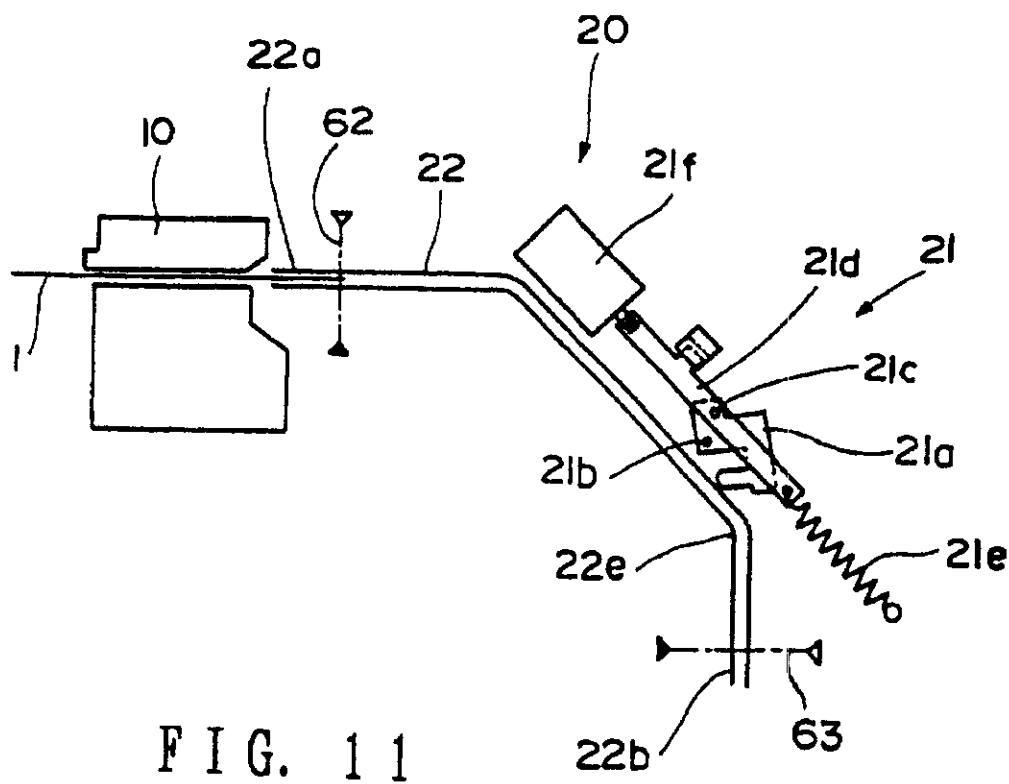
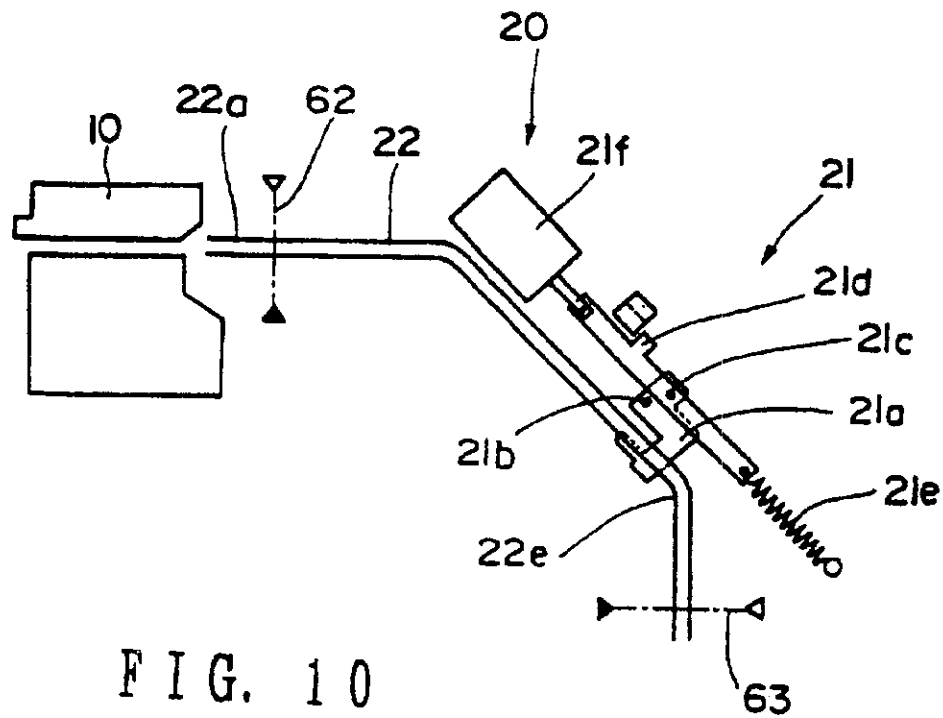
FIG. 9

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BILL HANDLING APPARATUS WITH EXCHANGEABLE PUSHER FOR STACKER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an apparatus for handling paper money, such as a bill exchanger, an automatic bending machine, etc., more particularly, concerns a currency handling apparatus provided with a stacker to store bills fed into the apparatus.

2. Description of the Prior Art

A current bill handling apparatus includes money exchanging or vending machines each provided with a paper money detecting device or a validator for identifying the authenticity or denomination of a bill, bank note or paper currency inserted therein. When inserted into an inlet of the validator, the bill is conveyed along a passageway by a belt-pulley arrangement through sensors which detect optical or magnetic characteristics of the bill. In a typical bill handling apparatus of this kind, the validator discriminates between real money and counterfeit money for a bill fed into the apparatus by a central processing unit (CPU) composed of a microcomputer on the basis of data detected from the bill, and it passes a bill only when judged as valid and real money. After the validator checks the inserted bill and detects same physical properties as those of a genuine bill from outputs of the sensors, the validated bill is transported by the conveying device and stored in a compartment of a storing box called "stacker" wherein bills are accumulated for storage while exchanged bills, coins or goods are put out in a tray of the machine. Adversely, if the validator can not decide the inserted bill as genuine, the belt-pulley arrangement is driven in the reverse direction to return the bill to the inlet. For instance, U.S. Pat. No. 4,629,194 to Bob M. Dobbins, et al. indicates a prior art validator and U.S. Pat. No. 4,722,519 to John Zouzoulas shows a stacker apparatus.

When filled up with bills, the stacker is detached from the apparatus, and the bills are removed from the stacker, and the empty stacker is attached again to the apparatus. A pushing device is rigidly mounted in the stacker to forcibly push a bill supplied from the conveying device into the compartment in the stacker. This pushing device has link members connected into X shape each other with hinges, and each end of link members is attached to a pushing plate. Therefore, when the link members are operated for extension or retraction, the pushing plate is moved forward or backward to forcibly push the bill into the compartment of the stacker. Also, provided in a casing of the stacker is a slit-shaped intake port connected with an exit of a passageway of the conveying device to smoothly convey a bill.

However, as a pushing device of the conventional bill handling apparatus is fixedly incorporated in a stacker as one unit, it needs a new stacker with a pushing device to increase or reduce capacity or volume for storing bills in the stacker. Therefore, a conventional bill handling apparatus has defects in that the pushing device can not be exchanged with another one and in that bill storing capacity can not easily be adjusted. Also, when a pushing device under malfunction or breakdown is required to be replaced with new one, it needs replacement of an incorporated stacker itself, and thereby makes maintenance operation difficult.

SUMMARY OF THE INVENTION

Accordingly, it is an object of this invention to provide a bill handling apparatus with an exchangeable pusher for stacker.

It is another object of the invention to provide a bill handling apparatus with exchangeable pusher for easy maintenance.

It is still another object of the invention to provide a bill handling apparatus with exchangeable pusher being capable of preventing unauthorized withdrawal of a stacked bill.

A bill handling apparatus according to the present invention includes a validator for checking a bill fed into the apparatus whether or not the bill is genuine; a stacker detachably mounted in the apparatus and having a casing for defining a compartment to store the accumulated bills; and a transporter for conveying the bill along a passageway from the validator to the stacker. The stacker further comprises a chamber defined by the casing; a pusher removably located within the chamber of the stacker and drivingly connected with the transporter for pushing the bill into the compartment; an opening formed in the casing in the vicinity of the chamber for passing the pusher; and a slit-shaped inlet formed in a base plate of the pusher for receiving the bill within the pusher. The inlet is connected to an exit of the passageway of the transporter. The transporter comprises a motor for driving an endless belt and an end gear driven by the motor. The pusher comprises a passive gear for operating link members to push the bill from the chamber into the compartment. The passive gear is brought into engagement with the end gear of the transporter for driving connection. The passive gear may be disengaged from the end gear when the stacker is removed from the transporter. The transporter further comprises a gear bracket for hingedly supporting the end gear; and a shock absorbing spring provided between the gear bracket and a frame of the apparatus for absorbing impact force produced between the end and passive gears when the stacker is incorporated with the transporter. The pusher comprises link members and a pusher plate hingedly connected with the link members. The link members travel the pusher plate between the retracted and extended positions by virtue of elastic force of a spring and driving force of a motor provided in the transporter. The pusher comprises a winding gear rotatably mounted on a shaft and being brought into engagement with an end gear of the transporter for disengagement when the stacker is incorporated with the transporter; a winding roller mounted on the shaft via one-way clutch device contained therein; a slider slidably mounted on a base plate of the pusher for hingedly supporting one end of the link members; a slider pulley rotatably mounted on the slider; a slider spring for resiliently urging the slider away from the shaft; and a tensile wire wound around the slider pulley. One end of the tensile wire is connected with the base plate and the other end of the tensile wire is wound around the winding roller. Thereby, the one way clutch device allows to release the tensile wire from the winding roller by resilient force of the slider spring when the motor is driven in the forward direction to convey the bill through the passageway in the transporter so that the slider is moved away from the winding roller, and the link members and pusher plate are carried to the retracted position. The one-way clutch device serves to rotate the winding

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roller together with the shaft to wind up the tensile wire around the winding roller when the motor is driven in the reverse direction so that the slider is moved toward the winding roller, and the link members and pusher plate are carried to the extended position.

The stacker comprises a pair of guide members each attached on a side wall of the casing; and a back plate movable along a pair of the guide members; The stacker further comprises a spring for resiliently urging the back plate toward the pusher; and a pair of stoppers each provided at both ends of the guide members to prevent the back plate from entering into a front portion of the compartment. The transporter provides at least a bent portion with the passageway and comprises hook means for preventing extraction of the bill within the stacker out of the apparatus. The hook means is mounted between the bent portion and the stacker, and comprises sensing means provided on the passageway within the transporter for detecting passage of the bill supplied from the validator; a lever rotatable between its operative position projecting into the passageway and its inoperative position retracted from the passageway; and drive means for operating the lever of the hook means when the sensing means detects the passage of the bill.

The pusher may be removed from the casing of the stacker and attached to another stacker with a casing of different capacity for storing bills. In order to change capacity or volume for storing bills in the stacker, the pusher may be applied for common use to another stacker with its compartment of different volume, and therefore there is no need to prepare a new pusher of different size or type. In addition, when the pusher is in malfunction, it may easily be removed for exchange with a new pusher and a same pusher is applicable to stackers of various size without change of the pusher in size and without increase of kind or type of the pusher for easy maintenance. The pusher can easily be inserted along the guide members in the chamber within the casing of the stacker.

The lever of the hook means can receive a tool which might be inserted to rotate the lever for the purpose of unauthorized withdrawal of the bill in the stacker to prevent further insertion of the tool. A back side of the lever prevents unauthorized withdrawal of the bill connected with a string-like material which may be pulled outside the inlet.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view of an embodiment of a bill handling apparatus according to the present invention.

FIG. 2 is a perspective view of a driving mechanism of the transporter used in the bill handling apparatus of FIG. 1.

FIG. 3 is a cross-sectional view of a stacker and a pusher attached thereto.

FIG. 4 is a cross-sectional view of the pusher.

FIG. 5 is a plan view of the pusher.

FIG. 6 is a plan view illustrating a drive mechanism of the pusher.

FIG. 7 is a partial perspective view of the stacker.

FIG. 8 is a cross-sectional view indicating another embodiment of the bill handling apparatus of the present invention.

FIG. 9 is a perspective view of a transporter mounted on the bill handling apparatus of FIG. 8.

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FIG. 10 is a simplified cross-sectional view of the transporter of FIG. 9 with hook means in operative position.

FIG. 11 is a simplified cross-sectional view of the transporter of FIG. 9 with hook means in inoperative position.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIGS. 1 through 7, an embodiment of a bill handling apparatus according to the device will be described as follows:

FIG. 1 shows a cross-sectional view of an embodiment of the bill handling apparatus according to the present invention. The bill handling apparatus comprises a metallic frame Z; a validator 10 for identifying the authenticity or denomination of a bill or paper currency inserted therein; a conveying device or transporter 20 provided in the frame 2 for conveying the bill 1 supplied from the validator 10 along a passageway defined by guide members 22; a stacker 50 detachably attached to the frame 2 for storing in a compartment 51 the bill 1 traveled from the transporter 20; and a pushing device or pusher 30 provided in the stacker 50 for pushing the bill 1 into the compartment 51. The pusher 30 is drivingly connected with the transporter 20 to obtain drive force.

In FIG. 1, the validator 10 is provided with an inlet 11 at the front side and an inner passageway (not shown) therein following the inlet 11. An exit of the passageway in the validator 10 is connected with a connecting end 22a of the passageway formed by the guide members 22. A rear end 22b of the passageway is connected with the stacker 50.

The validator 10 includes detecting means not shown because well known for detecting various physical properties of the bill 1 to determine whether or not it is genuine. As known, sensors of the validator 10 detects magnetic and optical properties of the bill from ingredients of printed inks, paper quality and the colors thereof.

As shown in FIG. 1, the stacker 50 is detachably housed for sliding movement in the frame 2. As shown in FIGS. 1 and 2, an endless belt 23 is wound around pulleys 24a-24c to convey the bill 1 along the passageway of the guide members 22. Therefore, the bill 1, which has been passed through the validator 10, is then transported through the passageway within the transporter 22 by the endless belt 23 and then goes toward the stacker 50. Optical sensors (not shown) are provided to detect passage of the bill 1 through the validator 10 and produce a detection signal to the CPU to start rotation of the motor 25 in one direction.

A motor 25 of driving source operates the endless belt 23 by operating signals supplied thereto from a CPU provided in the validator 10. The rotation of the motor 25 is transmitted to the pulley 24a mounted on a shaft 25c via a gear 25d engaged with a gear 25b mounted on a shaft 25a of the motor 25 to drive the conveying belt 23 by the pulley 24a.

As shown in FIG. 2, a drive gear 26a is mounted for rotation on a shaft 25f of the pulley 24c around which the endless belt 23 is wound. The shaft 25f also supports a gear bracket 27 for rotation in addition to the drive gear 26a which is meshed with a middle gear 26b engaged with an end gear 26c for reduction to necessary rotational rate. These middle and end gears 26b and 26c are supported for their rotation by pins 27a, 27b on the

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gear bracket 27 so that the middle and end gears 26b, 26c can be rotated by themselves and swayed together with the gear bracket 27 around the shaft 25f. One end of a shock absorbing spring 28 is attached to an extremity of the gear bracket 27 and the other end of the shock absorbing spring 28 is fixed to the frame 2 (not shown). Usually, the extremity of the gear bracket 27 is in contact with a stopper pin 29 to prevent its further rotation. However, the gear bracket 27 is rotatable in the clockwise direction around the shaft 25f against elastic tensile stress of the shock absorbing spring 28.

The end gear 26c is brought into engagement with a passive gear 44 shown in FIGS. 1 and 4 when the stacker 50 is inserted into the frame 2 for incorporation with the transporter 20 after the pusher 30 is disposed within the stacker 50. When the end gear 26c contacts the passive gear 44, produced between these gears 26c and 44 is impact force which is absorbed by elastic tensile force of the stock absorbing spring 28 at the time of rotation of the gear bracket 27 around the shaft 25f to establish smooth engagement between the middle gear 26c and the passive gear 44. However, when the stacker 50 is removed from the frame 2, the end gear 26c is disengaged from the passive gear 44.

As shown in FIG. 3, a box-shaped casing 50b of the stacker 50 is provided with an opening 50a through which the pusher 30 may be placed in or removed from a chamber 53 within the casing 50b. Also, the casing 50b has, adjacent to the chamber 53, a compartment 51 to receive and stores bills. The pusher 30 is located within the chamber 53 in position when a bent portion 31c of a base plate 31 of the pusher 30 is in contact with a stopper 50b of the casing 50b. The pusher 30 may be secured within the casing 50b by means of a screw (not shown).

As shown in FIG. 4, the pusher 30 has a base plate 31 formed with a slit-shaped inlet 59 and a pushing plate 32. The pushing plate 32 may be moved away from and toward the base plate 31 in parallel relation via two pairs of two link members 33 which are hingedly connected with each other in "X" shape by an axle 34 passing through each center portion of these link members 33. FIG. 5 indicates the link members 33 substantially symmetrically provided on each side of the pusher 30. Shafts 33a to 33d are utilized to hingedly connect each end of the link members 33 with the base plate 31 and the pushing plate 32 to cause parallel movement of the pushing plate 32 relative to the base plate 31.

The fixed shaft 33a hingedly connects one end of the link member 33 with the pushing plate 32. The fixed shaft 33c hingedly connects one end of the link member 33' with the base plate 31. Rigidly secured to the base plate 31 is a bracket 35 having a pair of bent portions 35a each formed with an elongated hole 35a. As illustrated in FIG. 6, positioned inside the bent portions 35a of the bracket 35 is a slider 36 having a pair of bent portions 36a. The shafts 33b pass through holes formed with bent portions 36a and are movable within the elongated holes 35a of the bracket 35. The shafts 33b support each end of the link members 33 to hingedly connect the other end of the link member 33 with the slider 36. Similarly to the shaft 33b, a shaft 36b pass through holes formed with the bent portions 36a and are movable within the elongated holes 35 of the bracket 35 integrally with the shaft 33b. Each one end of a pair of tensile springs 37 is engaged with the shaft 36b, and each the other end of the tensile springs 37 is engaged with an axis 31a secured to the base plate 31. A pulley 48 is attached to the slider 30 for rotation. The shaft 33d

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hingedly connects the other end of the link member 33' with the pushing plate 32, and is movable along a bent edge 32a of the pushing plate 32.

As shown in FIGS. 4 and 6, a winding gear 42 and passive gear 44 are respectively mounted for rotation on shafts 41 and 45 which are supported by the base plate 31. A middle gear 43 is engaged between the gears 42 and 44 to transmit rotational force from the shaft 45 to 41. Mounted on the shaft 41 is a winding roller 46 which has an one-way clutch device (not shown) disposed between the shaft 41 and the winding roller 46.

Fixed to the winding roller 46 is one end of a tensile wire 47 which is wound around a roller 40 mounted on a shaft 39 and a pulley 48 rotatably supported on the slider 36. The other end of the wire 47 is fastened to a pin 49 fixed to the base plate 31. Wound around the shaft 41 is a twisted spring 38 both ends of which are respectively fixed to the winding roller 46 and the base plate 31 to prevent the tensile wire 47 from being loosened when the winding roller 40 is forcibly rotated.

Due to the one-way clutch device of the winding roller 46, the winding roller 46 is rotated to wind up the tensile wire 47 therearound while the shaft 41 is rotated in the reverse direction, however, the winding roller 46 is free when the shaft 41 is rotated in the forward direction and thereby the tensile wire 47 is released from the winding roller 46 because the pulley 48 together with the slider 36 is moved away from the winding roller 46 by elastic force of the tensile springs 37. As understood from FIG. 4, when the shaft 41 is rotated in the reverse direction to wind up the tensile wire 47 around the winding roller 46, the pulley 48 is pulled by the tensile wire 47 so that the slider 36 and shaft 33b are moved toward the winding roller 46 and therefore the pushing plate 32 stretches from the base plate 31 to the extended position within the compartment 51. Adversely, when the shaft 41 is rotated in the forward direction, the pulley 48, slider 36 and shaft 33b are moved away from the winding roller 46 so that the pushing plate 32 is returned to the retracted position toward the base plate 31 beyond the rest position 60 of the bill 1.

When the stacker 50 is inserted into the frame 2, the passive gear 44 is brought into engagement with the end gear 26c so that the rotational force of the end gear 26c is smoothly transmitted to the passive gear 44 and hence the winding gear 42 is rotated via the middle gear 43. Thus, the link members 33 are driven by the motor 25 of the transporter 20.

If the transporter 20 is driven by the motor 25 to carry the bill 1, the pusher 30 is inoperative due to the one-way clutch device of the winding roller 46. For that reason, the pusher plate 32 is returned to the retracted position by elastic force of the tensile springs 37 until the bill 1 supplied from the inlet 59 reaches the rest position 60 between the pusher plate 32 and back plate 54 so that the bill 1 can be pushed by the pusher 30 into the compartment 51.

A sensor (not shown) detects passage of the rear end of the bill 1 which has passed through the transporter 20 and reached the rest position 60 within the pusher 30. In accordance with the detection signals produced by the sensor upon passage of the bill 1, the CPU generates outputs to reversely rotate the motor 25 whose driving force is transmitted through the shaft 25, gears 25b, 25d, shaft 25c, pulley 24a, endless belt 23, shaft 25f, gears 26a to 26c, gears 44, 43, 42, shaft 41 and winding roller 46. Thus, the winding roller 46 is rotated via the one-way

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clutch device of the winding roller 46 to operate the pusher 30.

As shown in FIG. 3, a door plate 52 is attached to the bottom of the casing 50b by a hinge shaft 52a to open or close the door plate by rotation. As shown in FIGS. 3 and 7, positioned within the compartment 51 of the stacker 50 is a back plate 54 formed with a pair of cut-aways 54a that respectively engage with a pair of guide members 55 respectively arranged on side walls of the casing 50b. The back plate 54 may move along the guide members 55. The back plate 54 is resiliently urged by two springs 56 toward the chamber 53. A pair of stoppers 57 are formed at both ends of each guide members 55 to prevent further movement of the back plate 54 into the chamber 53 upon contact of the back plate 54 and the stoppers 57. As illustrated in FIGS. 4 and 5, the base plate 31 has a pair of aprons 31b which project from both edges of the base plate 31. When the pusher 30 is inserted into the casing 50b, the aprons 31b of the base plate 31 are brought into contact with the stoppers 57 and then the pusher 30 is moved along and guided by the stoppers 57 and thereby the pusher 30 can be easily housed in the chamber 53 of the casing 50b. Width of the pushing plate 32 is slightly smaller than a distance between the guide members 55 so that the pushing plate 32 can be moved within the compartment 51 toward and away from the back plate 54.

When the bill 1 supplied from the transporter 20 reaches the rest position 60 before the back plate 54 engaged with the stoppers 57, the pusher 30 operates to travel the pushing plate 32 toward the back plate 54, and therefore the bill 1 is pushed into the compartment 51 and upon further movement of the pushing plate 32, the bill 1 and back plate 54 are moved away from the pusher 30 against elastic force of the springs 56.

In assemblage, the pusher 30 is inserted into the stacker 50 from the opening 50a of the casing 50b and is disposed in position upon contact of the bent portion 31c of the base plate 31 and the stopper 50c of the casing 50b. Then, the stacker 50 is inserted into the frame 2 of the apparatus so that the inlet 59 of the pusher 30 is connected with the rear exit 22b of the guide members 22. At the same time, the passive gear 44 of the pusher 30 comes into engagement with the end gear 26c to transmit rotating force from the passive gear 44 to the end gear 26c. The shock absorbing spring 28 reduces impact force produced between the passive gear 44 to the end gear 26c.

In use, a bill 1 is inserted into the inlet 11 of the validator 10 and is conveyed by the belt-pulley arrangement into the validator 10 to check whether or not it is a genuine bill. When the CPU decides that the bill 1 is not a genuine bill by electric signals of physical properties of the bill 1, the belt-pulley arrangement is reversely operated to return the bill 1 to the inlet 11. When the CPU validates that the bill is a genuine bill, the belt-pulley arrangement conveys it to the connecting end 22a of the passageway within the transporter 20. Then, the bill is forwarded by the endless belt 23 along the passageway toward the stacker 50 while the endless belt 23 is driven by the motor 25, however the winding pulley 46 is not rotated due to inoperative condition of the one-way clutch device when the pushing plate 32 is in the retracted position.

Subsequently, the bill 1 is supplied by the transporter 20 through the inlet 59 into the rest position 60 of the pusher 30 and the sensor detects arrival of the bill to the rest position 60 to produce a detection signal upon

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which the CPU causes the motor 25 to reversely rotate. So, driving force of the endless belt 23 rotates the winding pulley 46 to wind up the wire 47, and therefore, the link members 33' are stretched and the pusher plate 32 is moved from the retract to extended position. Thereby, the bill 1 in the rest position, is pushed into the compartment 51 together with the back plate 54 against elasticity of the springs 56.

After the bill 1 is pushed into the compartment 51, the motor 25 is again rotated in the forward direction and the slider 36 is pulled toward the side of the fixed axis 31a of the base plate 31 by restoring force of the springs 37, and then, the link members 33 are retracted so that the pushing plate 32 is returned to the retracted position. At the same time, the back plate 54 is moved by restoring force of the spring 56 toward the pusher 30, and thereby the bills 1 loaded on the back plate 54 is pushed toward a pair of edges 31c of the pusher 30. This operation is repeated until a predetermined amount of the bills 1 are accumulated within the compartment 51.

When the stacker 50 is removed from the frame 2, the passive gear 44 of the pusher 30 is automatically disengaged from the middle gears 26c of the transporter 20. When the door plate 52 of the stacker 50 is opened, the bills 1 may be removed from the compartment 51 while the back plate 54 is moved toward the stoppers 57 along the guide members 55 by restoring force of the springs 56 until the back plate 54 makes contact with the stopper 57.

When the fixing screw (not shown) for the pusher 30 is loosened and removed from the casing 50b, the pusher 30 may be removed from the casing 50b of the stacker 50 and attached to another stacker with a casing of different capacity for storing bills.

In order to change capacity for storing bills in the stacker, the pusher 30 may be applied for common use to another stacker with its compartment of different volume and therefore there is no need to prepare a new pusher of different size or type. In addition, when the pusher 30 is in malfunction, it may easily be removed for exchange with a new pusher 30. Obviously, this means that a same pusher 30 is applicable to stackers of various size without change of the pusher in size and without increase of kind or type of the pusher for easy maintenance. The pusher 30 can easily be inserted along the guide members 55 in the chamber 53 within the casing 50b of the stacker 50.

FIGS. 8 to 11 indicate another embodiment of the present invention which is provided with hook means 21 to prevent unauthorized withdrawal of the bill in the stacker 50 outside the apparatus. The hook means 21 comprises a shaft 21b attached to the frame 2 near a bent portion 22e of the passageway defined by the guide members 22; a lever 21a rotatably mounted on the shaft 21b and formed with notches 21g; a drive member 21d connected with the lever 21a via a connecting pin 21c; a solenoid 21f as drive means for pulling the drive member 21d upon energization; a tensile spring 21e mounted between the drive member 21d and a shaft 64 secured to the frame 2; and an optical sensor 60 for detecting movement of the drive member 21d. Also, provided near the connecting end 22a and rear end 22b of the guide members 22 are optical sensors 62, 63 for detecting entrance and discharge of the bill 1. Electric outputs from these optical sensors 62, 63 are supplied to the CPU to operate the solenoid 21f. Pulleys 24d and 24e are provided to smoothly convey the bill 1 along the passageway.

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The lever 21a is usually in an operative position as shown in FIG. 10 projecting into the passageway of the bill 1 so that the notches 21g can receive a tool which might be inserted to rotate the lever 21a for the purpose of unauthorized withdrawal of the bill 1 in the stacker 50. A back side of the lever 21a prevents unauthorized withdrawal of the bill 1 connected with a string-like material which may be pulled outside the inlet 11 as further rotation of the lever 21a is prevented. When entrance of the bill supplied from the validator 10 is detected by the optical sensor 62, the solenoid 21f is operated to pull the drive member 21d against elastic force of the spring 21e and therefore, the lever 21a is rotated from the operative position of FIG. 10 to an inoperative position of FIG. 11 wherein the lever 21a is retracted from the passageway to allow passage of the bill 1. When the optical sensor 63 detects discharge of the bill from the transporter 20, the optical sensor 63 furnishes a detection signal for the CPU which then ceases the output to the solenoid 21f. Accordingly, the drive member 21d is returned to its original position by elastic force of the spring 21e so that the lever 21c is returned to the operative position of FIG. 10.

Practical embodiments and modes of the present invention may be modified in various ways without limitation to the foregoing embodiment. For example, the stoppers 57 may be provided independently from the guide members 55.

As described above, since the pusher can be easily attached to or detached from the stacker in accordance with the present invention, the pusher may be used for various stackers of different size to change storing capacity of the compartment. Removal and replacement of the pusher are easy for maintenance or repair of the apparatus.

What is claimed is:

1. In a bill handling apparatus including a validator for checking a bill fed into the apparatus whether or not said bill is genuine; a stacker detachably mounted in the apparatus and having a casing for defining a compartment to store the accumulated bills; and a transporter for transporting the bill along a passageway from said validator to said stacker, the improvement comprising:

a chamber defined by said casing of said stacker; a pusher removably located within said chamber of said stacker and drivingly connected with said transporter for pushing the bill into the compartment;

an opening formed in said casing in the vicinity of said chamber for passing said pusher; and

a slit-shaped inlet formed in a base plate of said pusher for receiving the bill within said pusher, said inlet being connected to an exit of the passageway of the transporter.

2. The bill handling apparatus of claim 1, wherein said transporter comprises a motor for driving an endless belt and an end gear driven by said motor; said pusher comprises a passive gear for operating link members to push said bill from the chamber into the compartment, said passive gear being brought into engagement with said end gear of the transporter for driving connection, said passive gear being capable of being disengaged from said end gear when said stacker is removed from the transporter.

3. The bill handling apparatus of claim 2, wherein said transporter further comprises a gear bracket for hingedly supporting said end gear; and a shock absorb-

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ing spring provided between said gear bracket and a frame of the apparatus for absorbing impact force produced between said end and passive gears when said stacker is incorporated with said transporter.

4. The bill handling apparatus of claim 1, wherein said pusher comprises link members and a pusher plate hingedly connected with said link members; said link members traveling said pusher plate between the retracted and extended positions by virtue of elastic force of a spring and driving force of a motor provided in the transporter.

5. The bill handling apparatus of claim 4, wherein said pusher comprises a winding gear rotatably mounted on a shaft and being driven through an end gear of said transporter when said stacker is incorporated with said transporter; a winding roller mounted on said shaft via one-way clutch device contained therein; a slider slidably mounted on a base plate of said pusher for hingedly supporting one end of said link members; a slider pulley rotatably mounted on said slider; a slider spring for resiliently urging said slider away from said shaft; and a tensile wire wound around said slider pulley, one end of said tensile wire being connected with said base plate and the other end of said tensile wire being wound around said winding roller;

whereby said one-way clutch allows to release the tensile wire from the winding roller by resilient force of said slider spring when said motor is driven in the forward direction to convey the bill through said passageway in the transporter so that said slider is moved away from said winding roller, and said link members and pusher plate are carried to the retracted position; said one-way clutch device serves to rotate the winding roller together with said shaft to wind up the tensile wire around said winding roller when said motor is driven in the reverse direction so that said slider is moved toward said winding roller, and said link members and pusher plate are carried to the extended position.

6. The bill handling apparatus of claim 1, wherein said stacker comprises a pair of guide members each attached on a side wall of the casing; and a back plate movable along said pair of guide members;

7. The bill handling apparatus of claim 6, wherein said stacker further comprises a spring for resiliently urging the back plate toward the pusher; and a pair of stoppers each provided at both ends of said guide members to prevent said back plate from entering into a front portion of said compartment.

8. The bill handling apparatus of claim 1, wherein said transporter provides at least a bent portion with said passageway and comprises hook means for preventing extraction of the bill within said stacker outside the apparatus, said hook means being mounted between said bent portion and said stacker.

9. The bill handling apparatus of claim 8, wherein said hook means comprises sensing means provided on the passageway within said transporter for detecting passage of said bill supplied from said validator; a lever rotatable between its operative position projecting into said passageway and its inoperative position retracted from said passageway; and drive means for operating said lever of said hook means when said sensing means detects the passage of said bill.

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